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Manufacturing and Assembling Radio Instruments

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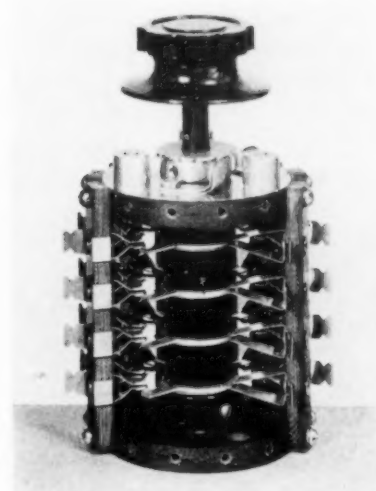
THE General Radio Company of Cambridge, Mass. is a manufacturer of electrical instruments of a highly technical character in which accuracy and the highest quality are essential. In the design of these instruments a great many parts are incorporated which are made of non-ferrous metals of various kinds, and involving numerous manufacturing operations which are of interest.

Perhaps one of the most highly developed instruments put out by this Company is its new standard-signal generator and it may well be used to illustrate the kind of work done here. This instrument is used to supply an accurately known source of radio-frequency voltage for the testing of radio receiving sets by the manufacturers of such products. It includes the equipment needed to supply a voltage continuously variable between 1 microvolt and 0.1 volt at any frequency between 9.5 kilocycles to 30 megacycles and has been designed for ease as well as accuracy of operation at a reasonable cost.

In order to meet these requirements it has been necessary to develop methods of producing the various parts which will keep down the costs and at the same time to select materials and ways of construction and fabrication which will insure the very best kind of service. Among the non-ferrous parts which are of particular interest are the following: silver

Some Interesting Operations on
Non-Ferrous Metals Carried on
by the General Radio Co., Cam-
bridge, Mass.

Fig. 1.
Band Change
Switch for
Obtaining
Different
Frequencies



switch contacts for the band-change switch; aluminum condenser plates; aluminum front panel which is lacquered and engraved; brass shelves for oscillating coils with each shelf carrying a sub-assembly for different parts of the instrument; sheet copper lining for the wooden cabinet; phosphor bronze contacts for the slide wire attenuator; nickel silver dials. The following gives some of the details of how these parts are made.

The band-change switch, by means of which differ-



Fig. 2.
Inspecting
Silver Switch
Contacts for
Band Change
Switch

ent frequencies are obtained, is shown in Fig. 1 and is provided with movable and fixed contacts of silver. The reason for using silver for these contacts is that it is essential to have extremely good electrical connections which never vary in resistance on account of the high frequency at very small current values which pass through them. The switch is used to select the coils which cover different frequency bands for testing. The material is purchased as spring tempered silver, .010" thick and has 4% more silver than Sterling. The strip is cut up in the shears, and the contact parts are blanked by punching. Five forming operations in small punch presses are required to make the fixed contacts into the proper final shape. As a general thing all of these operations are done on one press by putting through a lot for one operation, then changing the dies and proceeding with the next operation, and so on. The movable part of the contact consists of a brass punching, made in one operation, which fits on the shaft of the switch and is



Fig. 3.
Assembling
Band
Change
Switch

provided with a small arm. A piece of silver tubing is slipped over this arm and is flattened and soldered with the blow pipe for the contact. After this silver tubing is in place the whole is silver plated. As these switch contacts are an exceedingly vital part of the instrument they are very carefully in-



Fig. 4.
Assembling
Air Con-
densers

spected before the switch is completely assembled. Fig. 2 shows this inspection and Fig. 3 how the switches are assembled.

The variable air condenser used for oscillator tuning consists of a series of aluminum plates which are stationary and another series which turn between them. They are much like the familiar radio-receiver condensers but are more rugged and better made because of the accuracy and stability requirements to be met. The stator plates are assembled on threaded brass rods with brass spacers and the rotor plates are assembled on the shaft, also made of brass. The

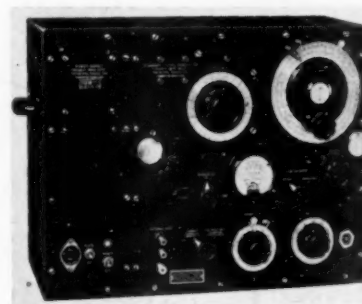


Fig. 5.
Standard Signal
Generator With
Lacquered
Aluminum
Panel

plates are punched in one operation, the material being 2S full-hard aluminum, 1/32" thick. The stock is purchased in the proper width so that it can be run through the punch press without previous shearing. The dies are maintained in such condition that the cuts are always very clean and without any burr. To obtain such results the dies are sharpened every 40-to-50,000 pieces. The posts which hold the frame together, and also the three short posts for mounting the condenser on the front panel, are of brass. The

two end plates are of aluminum, and the bearings for the shaft are of Tobin bronze. The latter are purchased outside. The posts are made of standard brass rod and threaded on ordinary screw machines. All of the brass parts are nickel plated. These condensers and their assembling are shown in Fig. 4.



Fig. 6.
Lacquering
Aluminum
Front Panel
With Spray
Outfit

The front of the instrument, shown in Fig. 5, consists of an aluminum panel which is lacquered and engraved. It is made of 3/16" sheet, 2S half-hard and cut to size by a circular saw. About fifty holes have to be drilled, and this is done by jig on six-spindle drill presses, the different spindles being equipped with drills of different sizes. The large hole for the dial is 2 7/8" in diameter, and this is punched after the drilling. However, the hole for the pilot of the punch is drilled while the panel is still in the jig.

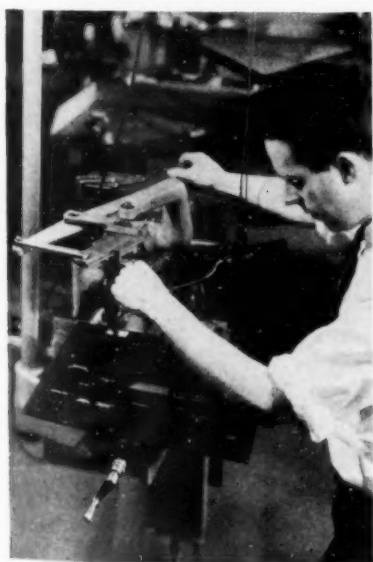


Fig. 7.
Engraving
the Front
Panel

Heavy burrs are then removed by countersinking, after which the piece is put on the sand belt. The surface receives its final finish by hand rubbing with

Fig. 8.
Attaching
Equipment
to Back of
Front Panel.
Putting One
of the Brass
Shelves in
Place



crocus cloth on a block to remove scratches. After this the aluminum panels go to the plating room for cleaning by dipping in potash followed by an acid dip and hot water rinse as a preparation for lacquering. This consists of spraying on a coating of black lacquer which is allowed to dry (Fig. 6). The second coating consists of black crackle which, when dry, leaves a somewhat grayish appearance. Consequently a third coat of black lacquer is applied to give the glossy black crackle finish. There is no baking. When these finish coats have thoroughly dried the panels are sent to the engraving department where the letters and figures are engraved by means of standard Gorton engraving machines (Fig. 7). These cut through the black crackle and into the aluminum so that the markings show white very plainly against the black background, and it is not necessary to fill them in with any pigment or its equivalent. The panels are now ready for the mounting of the equipment on them, which is done by means of small bolts and panel inserts as aluminum is considered too soft for threading for this kind of work. The back of the panel with the equipment is shown in Fig. 8.

It has already been stated that there are several

Fig. 9.
Bending the
Ends of the
Brass
Oscillator
Shelf





Fig. 10.
Oscillator
Assembly
Shelf With
Spot Welded
End Piece

sub-assemblies on brass shelves for the oscillator coils, and Fig. 8 shows one of these shelves being mounted on the back of the panel. There are three such assemblies but on account of differences in the equipment required all the shelves are different in size and shape. However, they are all made of brass sheet 1/16" thick. Stock brass sheet is purchased in sizes economical to use for the various shelves. They are sheared to the proper size and then drilled and punched with jigs. Whether punching or drilling is employed depends on the size of the piece and the size of the hole, the large holes being punched. The brass shelves are then bent into shape (Fig. 9) after which the end pieces for those which require them (as in the one shown in Fig. 8) are spot welded in place with four spots at each corner. The oscillator assembly in Fig. 10 shows a brass shelf with the welded end pieces.

The slide wire attenuators consist of non-inductive resistance coils in bakelite housings with contact springs on top. They are shown in Fig. 11. These contact springs are made of a brass lock collar and a phosphor bronze blade swedged together. The blades are punched in one operation and formed in a second. The whole unit is nickel plated to give a good finish.

The main frequency control dial is a nickel silver punching 1/16" thick made outside, and having a grain finish. It is shown in Fig. 12. The lettering, figures and divisions for the two inner scales are



Fig. 11.
Slide Wire
Attenuators
With Phosphor
Bronze Contact
Springs on Top

photo-etched but the outer divisions are engraved by the dividing head as they are small and great accuracy is necessary.

The cabinet in which all of the equipment is housed is lined with sheet copper for shielding purposes. Soft sheet copper .005" thick is used and installed with lapped joints and put together with escutcheon pins.

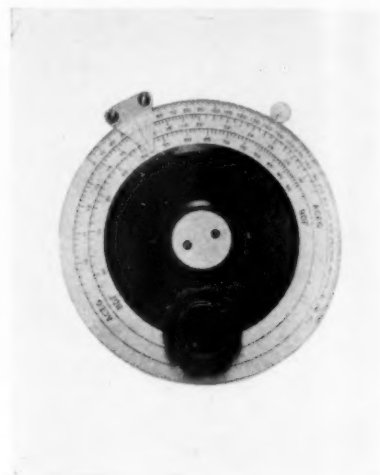


Fig. 12.
Main
Frequency
Control Dial
(Aluminum)

The copper is also bent so as to overlap the edges and make electrical contact with the aluminum panel. Fig. 13 gives a good idea of this copper lining.

Of course there are other non-ferrous metal parts in this standard-signal generator but the foregoing discussion is sufficient to show the extent to which a variety of materials are used and how they are made and assembled. It is an example of good efficient work where the quantity of finished products turned

Fig. 13.
Lining the
Cabinet
With Sheet
Copper



out is not large as compared with a plant manufacturing radio receiving sets, for example. Here most of the assembly is done by hand on benches. The Company makes a variety of instruments involving the use of electron tubes in all of which there are numerous non-ferrous parts of varying design to fit

the special purposes required. Among the instruments manufactured here are industrial devices such as the stroboscope, color comparator, sound level meter and an adjustable transformer for giving any voltage between zero and line voltage, and many other laboratory and testing instruments including condensers, oscillators, amplifiers and so forth. Steel and iron are used to only a very limited extent (mainly for magnetic circuits) so that the manufacturing equipment, and the methods employed relate to a very large extent to the processing of non-ferrous metals. Consequently a brief outline of what the plant consists of in the way of equipment will be of interest.

Many of the pictures already referred give a fairly good idea of what the shop looks like and the highly skilled character of the work. It is to be borne in mind, also, that while a good many different kinds of instruments are made here none of them are produced in great quantity and that the plant has been

laid out accordingly. For instance, the standard-signal generators which have been discussed in some detail are made in lots of about 100. This is a shop where high quality products of the precision type are turned out and where quantity production methods in the general sense are not applicable. These conditions give the plant its particular character.

The machines are largely standard types including brakes, shears, punch presses and spot welding equipment for use on sheet stock. There are also drill presses, milling machines, shapers and grinders; in short, whatever is required for working both sheet and solid stock, as well as for finishing castings.

Nearly all metal parts are either plated or lacquered. The plating room handles all kinds except chromium, which is little used, and when required is done outside. Lacquering of panels and other parts is done under hoods with standard spraying outfits, and the drying is done on portable metal racks.

Powder Metallurgy

By SAMUEL FRANKEL

H. Kramer & Co., New York

When does an industry stop being an infant?

That question was asked by Charles Hardy who acted as Technical Chairman at the American Society for Metals, New York Chapter, meeting February 15, 1937. The meeting was on Powder Metallurgy and the speaker was Gregory J. Comstock of Handy & Harman.

Mr. Comstock said that the powder industry was in its infancy but the possibilities and potentialities were great. While considerable knowledge has been gained and many theories have been evolved, much must still be learned about powder and its application.

The fundamental principle of powder metallurgy and the one which will be the main factor for industrial application is the fact that the products made of powdered metal display the physical characteristics of the component metals. Individual characteristics of metals are not lost as happens when alloying takes place by fusion.

Powder Metallurgy opens up a new field in producing materials which could not be produced in any other way. For example, it is the only method at present for making sheet and wire of tungsten and molybdenum, as these metals cannot be melted and cast. It is also the only means of combining certain metals which do not alloy such as graphite and copper.

The formation of articles from metal powders depends on three characteristics: (1) True cementing; (2) Adhesion; (3) Actual alloying of the metals.

Microstructure and size of the particles is very important. The structure depends on method of production. Electrolysis produces a crystalline form,

dendritic in shape. Gas reduction produces particles globular in shape. Size varies from 100 to 325 mesh.

In using powders, the various metals must be thoroughly mixed. They are then pressed with or without heat, and the articles produced may then receive heat treatment.

A recent development is the production of bi-metallic powders such as copper coated lead and silver coated molybdenum.

In view of a production of several million pounds of powder yearly, and with a continually growing field it is safe to say the industry has outgrown its infancy. The big field in powder metallurgy, however, seems to be in producing articles with powder, that could not be produced by other methods.

Small Rolling Mill

Q.—Would like to make inquiry on what it would cost to equip a small rolling mill and if there is a good market for thin-gauge metal.

A.—The term a small rolling mill is an elastic one; just what number of rolls you would install is not stated in your letter. We presume you have a re-rolling process in mind. A two-roll mill motor driven, with auxiliary equipment, annealing furnace, etc., plus installing would cost about \$15,000.

While there is a good demand for thin gauge metal, there is also at the present time, enough production by thin metal producers to take care of it. The business is a highly specialized one and largely competitive.—W. J. Pettis.

Institute Discusses Technical Aspects of Metallurgy

Papers on Orientation, Deformation, Physical Metallurgy and Properties of Alloys.

WELL attended meetings and deep interest in the papers read at the technical sessions were the outstanding features of the Winter Meeting of the Institute of Metals Division, A. I. M. E., held in New York at the Engineering Societies Building, February 17th and 18th. The program was highly technical, even theoretical, in some parts. One session was devoted to Orientation, another to Deformation, another to Physical Metallurgy and a fourth to Properties of Alloys. The discussions, while not over-active showed clearly the close attention which metallurgists are now paying to the more abstract aspects of metallurgical testing and investigation, and the application of the principles involved to the practical problems of alloying and metal products manufacturing.

Dr. Hutton Delivers Annual Lecture on Refractories

The Annual Institute of Metals Division lecture was delivered by Dr. R. S. Hutton, Professor of Metallurgy, University of Cambridge, England. Professor Hutton reviewed the advances made in refractories, summarizing them briefly, as follows:

1. The study of constitution diagrams of binary and ternary refractory oxides.
2. High pressure forming, de-airing and electro-casting.
3. The use of new materials, natural and artificial.
4. The standardization of testing methods.



New Vice Chairmen of the Institute
of Metals Division, A.I.M.E.

R. H. LEACH



R. F. MEHL

Improvement in the future, Professor Hutton visualizes, is coming through:

1. More stable and uniform components.
2. Fused or thoroughly shrunk refractory grain of high purity and uniformity.
3. Autogenous sintering processes for agglomeration.

Dr. Merica Delivers Howe Memorial Lecture on Cast Iron

The Howe Memorial Lecture was delivered by Dr. Paul D. Merica, Vice President of the International Nickel Company, New York, on the subject of Progress in the Improvement of Cast Iron and the Use of Alloys.

Dr. Merica attributed the rise in the cast iron industry largely to the improvement in the quality of the output brought about by the new alloys and heat treatments which have made iron castings practicable and suitable for a large number of new uses for which they were formerly considered inadequate.

Annual Institute Dinner

The Annual Dinner of the Institute of Metals Division was held on Thursday, February 18th, at the Commodore Hotel. The usual ceremonies were held. The new officers of the Institute were inducted into their respective offices for the coming year, as follows:

Chairman: **Albert J. Phillips**, Supt. Research Dept., American Smelting & Refining Co., Maurer, N. J.

Vice-Chairman: **R. H. Leach**, Manager, Handy & Harman, Bridgeport, Conn.; **Robert F. Mehl**, Director, Metals Research Laboratory, Carnegie Institute of Technology, Pittsburgh, Pa.

Secretary: **Louis Jordan**.

New members of Executive Committee, 3 years:

E. E. Schumacher, Metallurgist, Bell Telephone Laboratories, 463 West St., New York.

Carl E. Swartz, Cleveland Graphite Bronze Co., Cleveland, Ohio.

E. M. Wise, Asst. Mgr., Research Laboratory, International Nickel Co., Bayonne, N. J.

E. H. Dix, the retiring president, presented the annual certificate of award for the most notable Institute paper of the past three years to Dr. Arthur Phillips, professor of Metallurgy, Yale University, New Haven, Conn., and R. M. Brick, Research Assist-

ant in Metallurgy, Yale University, who had written on the subject of The Effect of Quenching Strains on Lattice Parameter and Hardeners Values of High Purity Aluminum-Copper Alloys. (New York Meeting, October, 1934). Mr. Dix also presented Dr. Hutton with a certificate of appreciation for his scholarly lecture on refractories (see above).

The meeting was addressed briefly by President Allen of the A. I. M. E., who expressed his pleasure at the high type of work being done by the Division. Albert Phillips, the new Chairman of the Division responded with a few words of thanks and appreciation of the understanding and cooperative attitude of the A. I. M. E.

The address of the evening was given by S. S. Wyer, Consulting Engineer of Columbus, Ohio on the subject, Contributions to a Way Out of To-day's Economic Muddle. The speaker analyzed the primary causes of our present-day difficulties and presented suggestions for overcoming them.



LOUIS
JORDAN
Secretary



E. E. SCHUMACHER
Member, Executive
Committee

Summaries of Papers

THE STEREOGRAPHIC PROJECTION

By CHARLES S. BARRETT

The paper gave an elementary explanation of the principles and methods of stereographic projection, covering the common applications in the field of metallography and physical chemistry.

AN INVESTIGATION TO DEVELOP HARD ALLOYS OF SILVER FOR LINING THE RING GROOVES OF LIGHT ALLOY PISTONS

By CLAUD G. GOETZEL

The object of this investigation was to determine whether silver alloys could be used instead of the currently employed insert of high-expansion austenitic ferro-nickel alloy to reduce the wear of ring grooves in light metal pistons. Alloys of magnesium-silver; manganese-silver; ternary alloys based on manganese-

silver; manganese, zinc and silver; manganese silicon and silver; quaternary alloys based on manganese, silicon and silver, and ternary alloys based on antimony-silver were experimented with.

While none of the alloys possessed the properties required, the data has value in other connections. The manganese-silver-silver and cadmium-antimony-silver alloys showed properties approaching those desired.

LEAD COATING OF STEEL

By J. L. BRAY

Steel or iron can be coated with lead by using zinc as a binding alloy if the temperature and composition of the bath are held within narrow limits. The resistance to corrosion of such lead coated sheets is apparently superior to that of ordinary galvanized material.

FATIGUE PROPERTIES OF FIVE COLD-ROLLED COPPER ALLOYS

By WILLIAM B. PRICE and RALPH W. BAILEY

These tests indicate that phosphorus in the amount of 0.106 per cent in the 95 Cu, 5 Sn bronze is detrimental to the fatigue properties of this alloy at stresses above the endurance limit.

It also seems clear that the phosphor bronzes are definitely superior to the silicon bronze, and to the Admiralty-nickel alloy.

The importance of the finish on the test specimens has been emphasized in this report, and the question of finish must always be considered when making recommendations for applications of metal parts where fatigue properties are important.

While great care was taken in all directions to make these results reveal a true comparison of the fatigue properties of the different mixtures tested, unanticipated irregularities may enter into any individual testing program, so that, pending further investigation, the summarized statements of this paper are presented as indications rather than final conclusions concerning the relative merits of phosphor bronzes and silicon bronzes.

PROPERTIES OF ALLOYS OF CADMIUM AND MERCURY WITH SMALL PERCENTAGES OF NICKEL

By TELFER E. NORMAN and OWEN W. ELLIS

The authors studied the micro-structures of a series of alloys containing 0.37-1.57 per cent nickel and 40% mercury. They subjected the above series, at room temperature, to compression, hardness, tension, cold bending and rolling tests. They studied the vapor pressure of mercury at the surface of solid alloys; also the rate of evaporation from the surface of the alloys immersed in hot oil. They also determined the temperatures at which these alloys became completely solid.

INFLUENCE OF TEMPERATURE ON ELASTIC LIMIT OF SINGLE CRYSTALS OF ALUMINUM, SILVER AND ZINC

By RICHARD F. MILLER and W. E. MILLIGAN

Slow tensile tests on ductile zinc single crystals at or above room temperature show that the magnitude of the apparent elastic range depends on the speed of testing, and the conclusion drawn from creep tests, that in this temperature range there is no measurable critical shearing stress, is supported.

Slow tensile tests on aluminum and silver single crystals show that there is a small but definite elastic range below the recrystallization temperature; this elastic range is smaller the lower the temperature. Above the recrystallization temperature the critical shearing stress decreases rapidly. Time was not available for creep tests on aluminum and silver, but it is expected that above the recrystallization temperature they would behave in a manner similar to zinc (no

measurable critical shearing stress would be encountered).

A marked yield-point elongation was noted in the aluminum single crystals, which was more marked the lower the temperature of the test and the purer the metal. During this period, increase of temperature decreased rather than increased the rate of flow. Following this period, the stress-strain curves crossed, and the temperature effect was normal; i.e., increase of temperature increased the rate of flow.

EQUIPMENT FOR ROUTINE CREEP TESTS ON ZINC AND ZINC-BASE ALLOYS AND AN EXAMPLE OF ITS APPLICATION

By J. RUZIKA

The ordinary tensile test and other routine tests do not reveal differences in strengths of materials as well as do tests at constant load and slower rates.

Constant-load, slow-rate tests are best made in creep equipment on standard specimens. Tests in such equipment, unlike "practical" comparison-tests, are readily standardized and yield absolute data of general value.

The particular creep equipment described in this paper offers a means of making such creep tests accurately, conveniently and cheaply.

THERMAL AND ELECTRICAL CONDUCTIVITIES OF ALUMINUM ALLOYS

By L. W. KEMPF, C. S. SMITH and C. S. TAYLOR

The thermal and electrical conductivities of a number of commercial aluminum alloys have been determined. The relationship between thermal and electrical conductivity appears to be best defined by the equation $K = 5.02\lambda T \times 10^{-9} + 0.03$ where K is the thermal conductivity, λ the electrical conductivity, and T the absolute temperature. The heating involved in the determination of thermal conductivity brings about changes in structure, except in specimens properly annealed, which have a profound effect on conductivity. The conductivity of aluminum alloys containing relatively high concentrations of silicon is affected in a marked manner by the particle size and distribution of the silicon, conductivity decreasing

with increase in particle size. The $\frac{K}{\lambda T}$ ratio for silicon alloys generally has a larger value than that for the other aluminum alloys.

SEGREGATION IN SINGLE CRYSTALS OF SOLID SOLUTION ALLOYS

By ARTHUR PHILLIPS and R. M. BRICK

A special case of gravity segregation was found during the melting of solid solution alloys. It occurs upon heating through the solidus-liquidus range when the two component elements differ greatly in density.

Segregation during slow solidification along a

vertical temperature gradient was studied in numerous aluminum-base and copper-base binary solid solution alloys. It is believed that under conditions

the specimens at temperatures of known solubility limits.

The diffusion coefficients were calculated and the

		Copper			Magnesium	
	540° C.	490° C.	440° C.	440° C.	400° C.	365° C.
D, sq. cm. per sec. $\times 10^{-10}$	13.8	2.4	0.57	3.2	0.64	0.11
Q (Langmuir-Dushman)	31,400	31,400	31,500	29,000	29,600	30,300
Q (lnD-1/T line)		34,900			38,500	

eliminating gas and contraction pressures, the results show that interdendritic feeding took place in practically all specimens. Whether this feeding overcomes the natural tendency towards normal segregation or coring depends to a large extent on the diffusion rate of the solute element and the temperature conditions along the dendritic contraction channels.

The above basic factors are generally modified in ordinary practice by external casting variables and inherent alloy peculiarities.

DIFFUSION OF COPPER AND MAGNESIUM INTO ALUMINUM

By R. M. BRICK and ARTHUR PHILLIPS

The diffusion of copper and magnesium into aluminum has been studied at various temperatures, employing specimens where a eutectic of the solute and solvent metals was brought in clean and intimate contact with pure aluminum.

The depth-concentration relations in the diffusion zone were determined micrographically by reheating

change of the coefficient with temperature was noted. The heat of diffusion Q was calculated from the Langmuir-Dushman equation and from the slope of the lnD-1/T line.

The relative Q values derived from the Langmuir-Dushman equation are considered to be more accurate.

Several diffusion-zone structures, which showed straight-line markings and apparent lines of recrystallization, were examined, with the conclusion that no true recrystallization had occurred.

The other papers read included the following:

Studies Upon the Widmanstättan Structure, IX. The Mg-Mg₂Sn and Pb-Sb Systems, by Gerhard Derge, Arthur R. Kommel and Robert F. Mehl.

Lattice Relationships Developed by the Peritectic Formation of Beta in the Copper-zinc System, by Alden B. Greninger.

Relations Between Stress and Reduction in Area for Tensile Tests of Metals, by C. W. MacGregor.

Effect of Inverse Deformation on Recrystallization, by Paul A. Beck.

Electroplating Research Progress

Conference to be Held on Electroplating at the Palmer House, Chicago, Illinois, Tuesday, March 2, 1937.

THIS conference is being held during the Regional Meeting of the American Society for Testing Materials under the auspices of the Joint Committee of the A.S.T.M. and A.E.S. on exposure tests of plated coatings, and of the special committee of Sub-Committee VII of A-5 on methods of testing electroplated coatings. This notice is being sent to members of those committees, the Research Committee of the A.E.S., and other persons or firms who have taken part or expressed an interest in this project. All interested persons are invited to attend this meeting. The tentative program is as follows:

9:30 A. M.—Joint Committee:

1—Exposure tests of non-ferrous metals.

- Results of inspections to date.
 - Color photography in recording results.
 - Effect of cleaning and oiling surfaces.
 - Supplemental tests to be started in 1937.
 - Reports in June to A.S.T.M. and A.E.S.
- 2—Status of specifications for plating on steel.

Recommendations may be made to Sub-Committee VI of A-5 regarding revision or final adoption.

2:00 P. M.—Methods of Testing Electroplated Coatings on Ferrous and Non-Ferrous Metals:

1—Thickness.

- Metallographic.
- Stripping (average).
- Dropping and jet tests.
- Brenner's magnetic method (demonstration).
- Chord method.

2—Porosity.

- Ferroxyl.
- Persulphate.
- Trichloroacetic acid.

3—Accelerated Corrosion Tests.

- Salt spray.
- Intermittent immersion.

Persons who are not able to attend the conference may submit their comments on the above subjects to W. Blum, National Bureau of Standards, Washington, D. C., preferably before February 27th.

The Use of Indium in Fusible Alloys

By Dr. SIDNEY J. FRENCH
Colgate University,
Hamilton, New York

**A New Group of Fusible Metals
which Melt at Temperatures Be-
tween 116° and 162°F.**

THE term fusible alloy has been applied to alloys melting below the melting point of pure tin (231° C.). Many such alloys have been known for centuries and have been mentioned in writings at least as early as 1662.

Such alloys are commonly prepared from the common metals: lead, bismuth, tin and cadmium, since these metals all possess relatively low melting points. It is a well known fact that alloys of two metals melt at lower temperatures than the pure metals themselves provided the metals form neither compounds nor solid solutions with one another. The lowest melting combination is known as an eutectic alloy. Thus, while tin melts at 231° C., and lead at 327° C., the eutectic alloy containing 37 per cent lead and 63 per cent tin melts at 182.5° C.

With the addition of a third metal such as bismuth, a new ternary eutectic alloy can be obtained with a still lower melting point. The ternary eutectic alloy of bismuth, lead and tin has the proportions: bismuth 53%, lead 32%, and tin 15% and melts at 96° C. The quaternary alloy of these four metals has the proportions: bismuth 50%, lead 27%, tin 13% and cadmium 10% and melts at 72° C. This alloy is commonly known as Lipowitz alloy. It is from this alloy that the so-called fusible tea-spoons are generally prepared.

Occasionally, mercury is added to this alloy to produce alloys melting at still lower temperatures. However, the addition of appreciable percentages of mercury render the alloys very brittle and granular while the melting points are not sharp.

The production of stable alloys melting at below the melting point of Lipowitz alloy was largely stopped because there were no other common low melting metals. There are, however, several rather rare metals having melting points within the range of fusible alloys. One of these is indium. Within the past ten years the price of indium has fallen markedly, from ten dollars a gram to one dollar a gram.

The writer has undertaken to prepare and study the properties of a number of fusible alloys containing indium. The first series to be studied was, perhaps, the most complex, containing all four of the common metals plus indium. While the study of this

series is by no means complete, certain very interesting results have been obtained.

When small quantities of indium are successively added to the quaternary eutectic (Lipowitz alloy), the melting point of the new combination drops at the approximate rate of 1.45° C. for every one per cent of indium present. Thus, such an alloy containing 10% indium melts at approximately 58° C. The maximum lowering is reached at 47° C. with an alloy containing 18% indium. Further additions of indium raise the melting point. It is characteristic of eutectic alloys that they melt and freeze sharply though the melting point is usually slightly higher than the freezing point. The evidence indicates that this new alloy containing 18% indium approaches the eutectic composition of the quaternary alloy very closely, for it melts sharply at 46.9° C. and freezes just as sharply at 46.7° C. However, microphotographic studies have not yet been made nor has there been a complete chemical analysis made of the lowest melting fraction.

By using indium it is therefore possible to obtain alloys melting at any desired temperature between 47° C. and 72° C. Of course, alloys in the intermediate range do not melt quite as sharply as the eutectic alloys, the melting range being about two degrees. Obviously the cost of the alloy rises rapidly as the percentage of indium is increased. In other words, the cost is inversely proportional to the melting point. There seems to be a reasonable assurance, however, that the price of indium will fall considerably below its present level as new uses are found for the metal to stimulate production.

At present costs, these new fusible alloys are limited in their field of application to cases in which cost is not of major importance or in which the alloy can be recovered for repeated use. These alloys possess certain advantages over Lipowitz alloy for three reasons. The very low temperatures needed to melt the alloy calls for a minimum of heat consumption and produces a minimum of loss through vaporization of the metals. Indium is an extremely stable metal and undergoes little or no corrosion in air. It thus reduces corrosion loss in the alloy both by lending its own stability and by permitting working at low temperatures where corrosion is slight.

A number of uses for such low melting alloys have been suggested most of which depend on the fact that the molten alloy can be brought into direct contact with the human skin without discomfort. It is possible that such an alloy properly impregnated into suitable fabric would serve as a suitable cast for broken limbs. The heated material could be wrapped around the limb and the metal would then harden in place giving a rigid cast the position of which could be easily changed by melting the metal with hot water bags and readjusting the cast.

Casts of features or fingers could be taken by applying the molten alloy and permitting it to harden in place. Such casts could be plated with silver or copper and the alloy then melted off for further use, leaving a permanent impression of silver or copper. It is conceivable that under certain conditions it would be desirable to obtain permanent three dimensional finger print impressions in this manner. Owing

to the fact that the molten alloy can be easily handled and worked, it could well serve for the preparation by hand of art medallions and other models from which permanent impressions of copper or silver could be made. The preparation of satisfactory casts or molds depends on the property of slight expansion during solidification. While no coefficient of expansion has been determined for this alloy, it gives sharp impressions indicating a slight expansion on cooling.

Other suggested uses for these alloys are in the nature of thermal controls such as automatic sprinkler slugs, fire door retainers, etc.

Like other alloys of this general type, the new alloy is hard and with a rather low tensile strength and not very flexible. It has been shown that many alloys of this type are very brittle when loaded rapidly but quite flexible when loaded slowly. In this respect, they resemble pitch.

Report on Industrial Exhaust Systems

The American Standards Association, 29 W. 39th St., New York, has just released a report on fundamentals relating to the design and operation of exhaust systems which has a direct bearing upon the problem of occupational disease prevention. This report was presented at the recent National Conference on Silicosis in Washington by the Engineering Committee of the Conference.

While the occupational disease problem is partly a medical one, the matter of minimizing exposure to poisonous dusts, gases, and fumes is purely an engineering problem and includes the important problem of installing exhaust equipment that will carry off the toxic dusts and gases present in certain industrial processes such as rock drilling and spray painting. Different types of dusts and gases require different treatment. Yet there are certain fundamental engineering principles common to the control of all.

It is these basic engineering principles that the committee deals with in its present report. Today many state regulations demand that employers provide "adequate" ventilation. But what is "adequate"? Some laws and codes require a definite amount of static suction as an index of exhaust system efficiency, but there are other engineering principles involved. What are the minimum air velocities required to "capture" the dust arising from certain grinding wheel processes or the fumes from electroplating? To what extent is air-cleaning practical to prevent recontamination of plant air from the outside, or to permit recirculation of air discharged from the exhaust system in the plant? What pressure losses can an engineer

expect from the various types of elbows and branches common to exhaust piping? The report goes deeply into the question of plant layout, exhaust hood design, air velocities, methods of measuring static suction, etc. It also considers the matter of exhaust system piping and of maintenance.

The report is intended as a guide to those desiring to install and use exhaust systems as well as to the manufacturer and designer of such systems. The committee that developed this report does not consider it in any way final but hopes that through its critical analysis a body of technical experience may be built up on which to base future action in the elimination of industry's worst occupational disease hazard—toxic dusts and gases.

This is the first step in developing a set of separate standard specifications for exhaust hood designs and air velocities for each distinct process or industry in which the occupational disease hazard is present. In all this work a national committee of eminent toxicologists and pathologists headed by Dr. R. R. Sayers, Senior Surgeon of the U. S. Public Health Service, is acting in an advisory capacity to set threshold limits beyond which the presence of certain dusts and gases becomes a menace to workers.

The ASA committee on Exhaust Systems which released this report is working under the administrative leadership of the International Association of Industrial Accident Boards and Commissions.

Theodore Hatch, Division of Industrial Hygiene, New York State Department of Labor, is chairman of the subcommittee which drafted the report.

The Electrodeposition of Zinc

By **GEORGE B. HOGABOOM**
Hanson-Van Winkle-Munning Co.,
Matawan, N. J.

WITH the interest that has been recently created in electrodeposition of zinc it is advisable to ascertain all the conditions under which a zinc coating can be consistently produced that will not only be equal to what is now being done but that will be better.

Zinc Plate in the Past Not Satisfactory

For a long time electroplated zinc coatings have not been up to the standard required. The protection against corrosion obtained was often less than expected. In many cases a comparison with a hot dipped coating of equal weight electrodeposited zinc was definitely inferior. Recently, however, data have been assembled that are placing electrodeposited zinc on an equal basis with hot galvanizing and there is the promise that it may prove, in many cases, superior.

Looking at the electroplating process squarely it must be admitted that the reason for the adverse situation was that the electroplater has not given sufficient study to the preparation of the metal, the anodes used and the character of the deposit. With the careless thought that the zinc metal was by nature a protecting metal for steel and iron against the action of that insistent enemy of ferrous metals—corrosion—the electroplater just went through the indefinite series of operations and coated iron or steel with zinc. If the coating looked like zinc that was satisfactory as the magic properties of the zinc itself was expected to cover and overcome all the shortcomings of the plating processes.

It is little wonder then that cadmium that was deposited under definitely controlled conditions and gave a more attractive finish, stepped out from obscurity to a place beyond zinc, regardless of cost, in such a brief period after its intelligent introduction. And still more strange, it was not until there was a shortage of cadmium for electroplating purposes that any real thought was given to the improvement of the processes employed in the electrodeposition of zinc. One notable exception merits not only attention but interested and unstinted commendation. Dr. U. C.

* From The Monthly Review of the American Electro-Platers' Society, November, 1936.

Microscope and "Dropping Test" Give Different Results in Measuring Thickness of Deposits. Different Plating Conditions Give Different Types of Deposits.*

Tainton developed a process for depositing zinc at a current density that went beyond the limit of imagination for the production of a commercial coating. It is only a few days ago that the mention of depositing zinc of more than 0.001" in one minute and do this on a commercial productive basis would have caused comments with a smile of incredulity—yet today that very thing at 1000 amperes per sq. ft. is being done. The electroplater is indebted to the ingenuity and perseverance of Dr. Tainton and to the steel company that had the foresight to encourage him.

That process along with the decrease of cadmium for electroplating has directed attention to the production of better zinc coatings.

Problems Involved in Producing Satisfactory Zinc Coatings

There have been data published on the protective value of electrodeposited zinc in the proceedings of a large scientific society whose object is to set up standards. Upon reading the reports there is the unfortunate omission of essential information of the preparation of the basis metal, the composition of the zinc solution used, the current density employed, and the thickness and character of the zinc coating. Cannot the unprejudiced question be asked of what value any data assembled has upon the life of electrozinc coating compared with the coating produced by any other method? The electroplater and the plating engineer have a right to ask that question.

If it is necessary to prepare the surface of a metal so that an acceptable ornamental electrodeposited coating may be had, is it not equally or even more essential that the preparation of the basis metal be as good, if not better, if the value of the article is dependent upon the protective life afforded by the electrodeposited coating? Then the basis metal must be clean and free from imperfections that will prevent a good electrodeposit of zinc.

There is an insistent demand that the anodes for nickel or copper be of the highest purity and corrode in the plating solution without even a trace of metallics. Has the same quality of zinc anodes been de-

manipulated or are such detrimental impurities as lead being accepted complacently because of a slight differential in cost? How about the sludge formed on the anode due to oxidation of these impurities and its affect upon the character of the deposit that is to give up its life to protect the basis metal? In the plating solution in which an anode of pure zinc is attacked when no current is flowing, thereby forming a partially chemically corroded sludge are the laws of electrodeposition different from those governing the deposition of any other metal? Will not the particles of sludge created by the impurities or by this partial chemical corrosion have an electrical charge and be carried over to the cathode, not mechanically but electrically, and be the cause of rough and porous deposits? The anode must corrode only when the current is on and be as free from sludge and metallics as is demanded for any other anode.

The statement has been made that porosity of zinc deposits is not necessarily detrimental; that zinc will throw a protective influence over the steel or iron where porosity exists and prevent corrosion. Is that wholly true? While zinc has that very valuable property, is it not also the fact that where the basis metal is exposed that the protection given is due to an electrochemical reaction; that a cell is set up and that the rate of corrosion is increased at that spot? If there is considerable porosity or inclusions in the deposit will not the total sum of these numerous electrolytic cells materially decrease the protective life of the zinc coating? If the basis metal is clean and the coating of zinc is continuous, free from porosity, will not the same weight or thickness of zinc afford a longer life of protection? If, then, the value of electrodeposited zinc is based upon its protective life, more attention must be given to the method of producing the zinc coating.

You well know my opinion on "What is Under the Plate"—the effect of the basis metal on the structure of the electrodeposit.

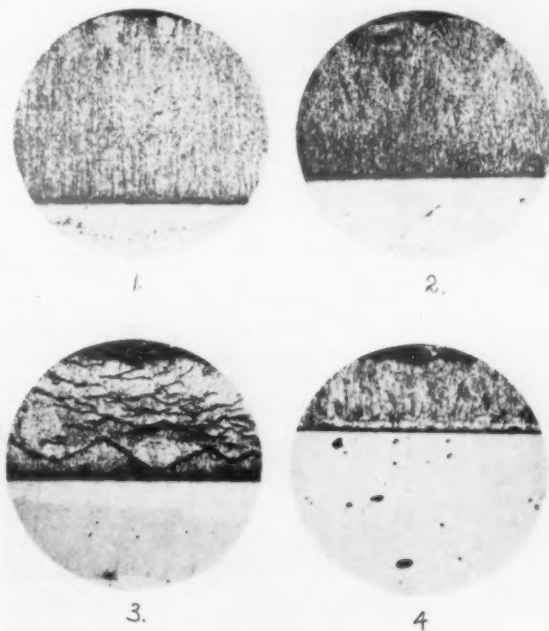
The question is now asked what effect has the structure of the deposit upon the protection of the basis metal, especially the structure of a zinc deposit? Are all zinc deposits alike? If not then what effect have they on the protective life of the basis metal when exposed to atmospheric conditions; upon any accelerated test for the determination of the thickness of the coating which has been set up as a standard for a specified life? Apparently no thought, or very little, has been given to the influence of the structure of the deposit in setting a value upon zinc coating. If the structure of the deposit has any effect whatever then what will bring about the changes in the structure of the deposit and how can a relatively uniform structure be maintained? The answer seems to be in the composition of the plating solution and the methods used in its operation.

Electrozinc coatings are being given the opportunity to prove themselves. What the status of zinc

coating will be in the future depends in a very large measure upon the electroplater. He must know the basis metal, the methods of preparing it for plating, the zinc anodes, the composition and control of the plating solution and the character of the electrodeposited coatings. Until all of this is known, any data on the value of electrozinc coatings or any specifications for the thickness of the deposit must be tentative and subject to revision. The electroplater can either firmly establish electrozinc coatings as superior to that produced by any other method or through carelessness and neglect pass up the opportunity that has been brought to his very feet.

Results of Experimental Work for Determining the Structure of Deposits

To obtain data upon which further investigation can be based experimental runs were made with zinc solutions. Solutions were made that had different percentage composition of the three component parts—the metal, the sodium cyanide, the sodium hydroxide. Commercial salts were used. The anodes were high purity cast zinc containing a definite percentage of aluminum and mercury. These anodes permitted the maintaining of a predetermined current density at a fairly constant pressure as there was no polarization of the anodes. The cathodes were rolled steel 2" x 4" which gave an area on both sides of 1/9



STRUCTURE OF DEPOSITS FROM ZINC CYANIDE SOLUTIONS.

	#1	#2	#3	#4
Zinc cyanide.	4.5	2.2	4.5	2.2 ozs/gal.
Sodium cyanide.	9.7	4.9	9.7	4.9 ozs/gal.
(Total)				
Sodium hydroxide.	7.5	3.8	2.4	1.2 ozs/gal.

All deposits at 15 ampere per sq. ft.

Plate 1. Showing Structures of Deposits from Various Zinc Cyanide Solutions

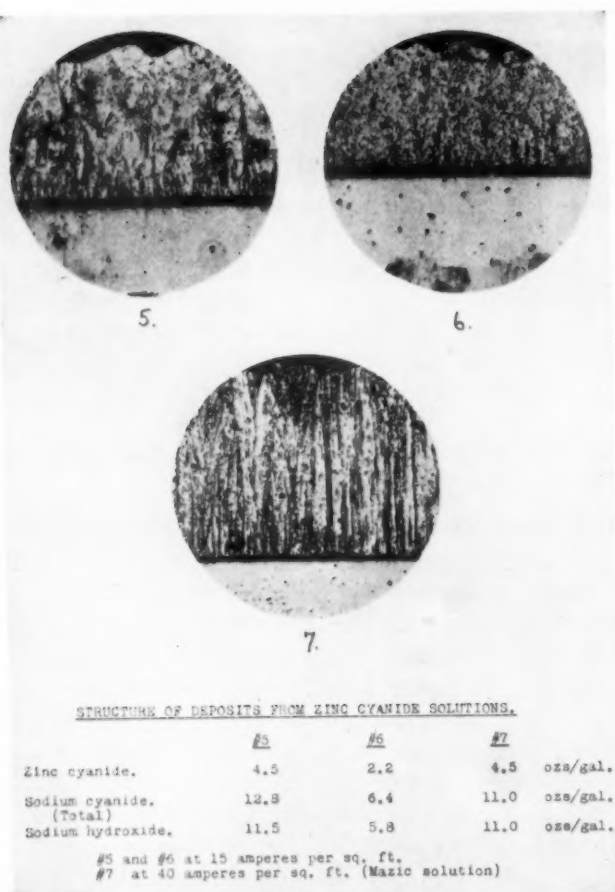


Plate 2. Structures of Deposits from Various Zinc Cyanide Plating Solutions

of a sq. ft. The anodes were of the same size, but as they were a slight distance from the wall of the glass cell, therefore some of the backs of the anodes were, no doubt, active and this gave a larger anode area than that of the cathode. The container was a glass battery cell about 4" x 10" which held 3.5 liters

—3 liters of solution were used. The distance between anode and cathode was constant—about 4.5". A current density of 15 amperes per sq. ft. was used, except as recorded. The pressure varied according to the resistivity of the solution. The time of running for microphotographs was 12 hours; that for the thickness determination was for 15 minutes, except for three runs. The solutions were run at room temperature.

The results of the experiments are given in the micrographs, curves, and data in the illustrations.

The structure of the electrodeposit was first studied. The micrographs are all 200x. There is a marked difference in the character of the deposit from the different solutions used both with the higher and the lower metal concentration (the lower concentration is always one-half of the composition of the higher concentration). Two solutions were run in series, i. e., No. 1 and No. 2, No. 3 and No. 4, No. 5 and No. 6. Solution No. 1 is what has been called a "standard" solution; No. 7 has a composition found best for a bright zinc solution, and was run at 40 amperes per sq. ft.

During the runs it was noted that to deposit zinc from solutions No. 3 and No. 4, which had a low sodium hydroxide content, a pressure of 6 volts was required, which is quite high. The micrograph indicated that the deposit was thin and that when the higher metal concentration was used the structure was unusual. It was thought that the resistivity of the solution was high; and, this was proved by a measurement of the resistivity which was made through the courtesy of M. R. Thompson, National Bureau of Standards. (See Plate 3).

It will be noted that the solution is not clear until the sodium hydroxide is about 5-oz. per gallon. This proves that sodium hydroxide is needed to take zinc

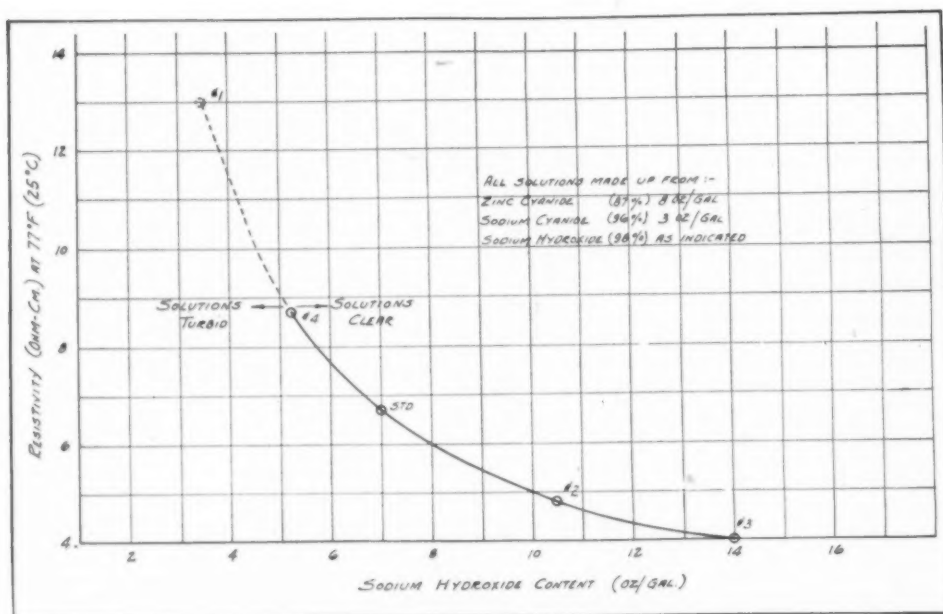


Plate 3.

Approximate Resistivity (ohm-cm) of Cyanide Zinc Solutions at 77° F (25° C.)

Solution	Stand- ard				
	No. 1* oz./gal.	No. 4 oz./gal.	No. 2 oz./gal.	No. 3 oz./gal.	No. 5 oz./gal.
Zinc cyanide	8	8	8	8	8
Sodium cyanide	3	3	3	3	3
Sodium hydroxide	3.5	5.25	7	10.5	14
Sodium hydroxide (Ratio to stand- ard)	0.5	0.75	1	1.5	2
Resistivity ... (13.0)	8.7	6.7	4.8	4.0	

* = Solution not clear. Filtrate measured.

cyanide completely into solution. This indicates also that if the sodium hydroxide content of a zinc cyanide solution is permitted to go below 5-oz. per gallon that there will be suspended salts in the solution, and in all probability this will cause a polarization of the cathode and that is, no doubt, the reason for the peculiar structure of the electrodeposit. The resistivity of the turbid solution is high.

In the solutions run there is a marked difference in the resistivity in relation to the sodium hydroxide concentration. In solutions having a low sodium hydroxide content it was reasoned that the cathode efficiency was low and that accounted for the thin deposits. Several runs were made in a previous research that indicated that this was true, and a repetition of some of the work proved it. Plate 4 illustrates the results obtained from a comparison of the Cathode Efficiency and the Current Density. When the sodium

hydroxide is high the cathode efficiency is high in solutions with high or low metal content and at all current densities. When the sodium hydroxide is low the cathode efficiency is very low. A composite picture of the effect of varying the concentration of the sodium hydroxide and the sodium cyanide is given in Plate No. 5, Fig. 1 (Page 112).

Generally one would be led to assume that if the cathode efficiency of a plating solution were high that the throwing power would be good. In many cases a solution that gave excellent results in a still tank did not work well in a plating barrel unit. This was thought strange until a comparative study was made of the relation between the cathode efficiency and the throwing power of the zinc cyanide solution. The results (Plate No. 5, Fig. 2, page 112) indicate that the concentration of sodium cyanide and sodium hydroxide must be reversed if good throwing power is desired.

Plate 4. Results From a Comparison of the Cathode Efficiency and Current Density in Various Zinc Cyanide Solutions

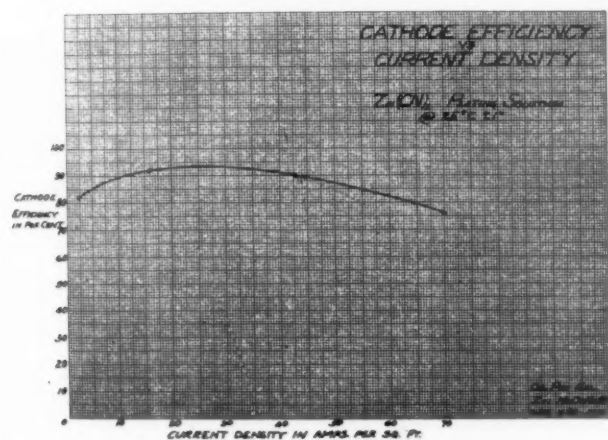


Plate 4. Fig. 1. Zinc 2 oz.; Sodium Cyanide 2.80 oz.; Sodium Hydrate 11 oz.

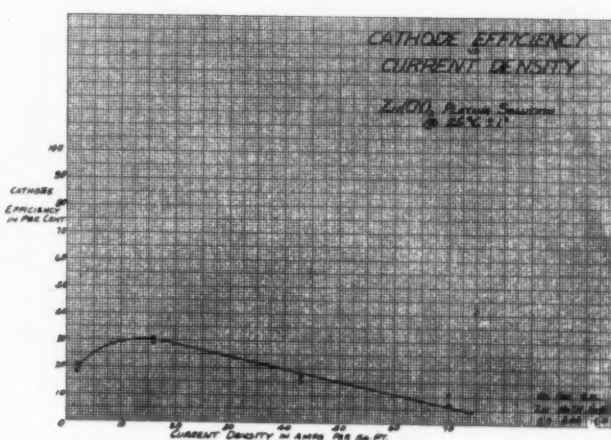


Plate 4. Fig. 2. Zinc 2 oz.; Sodium Cyanide 9 oz.; Sodium Hydrate 11 oz.

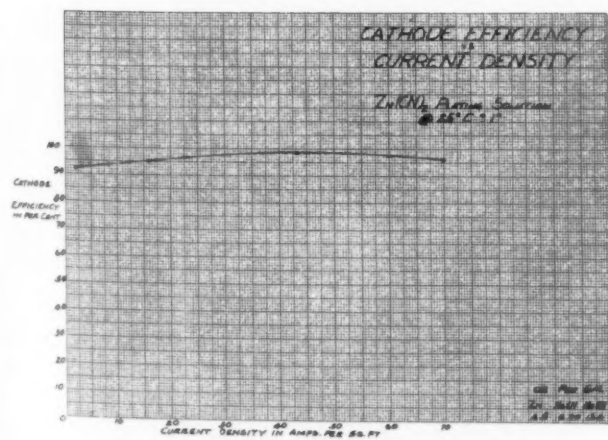


Plate 4. Fig. 3. Zinc 4.5 oz.; Sodium Cyanide 6 oz.; Sodium Hydrate 13 oz.

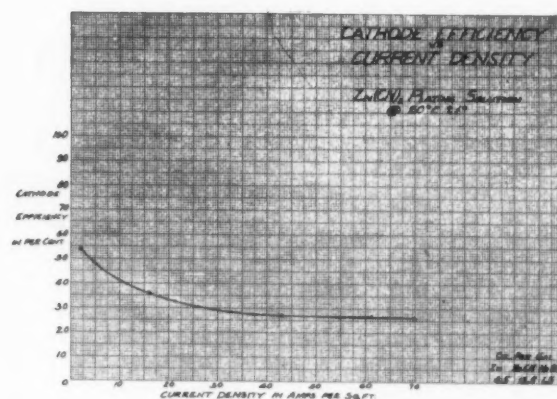


Plate 4. Fig. 4. Zinc 4.5 oz.; Sodium Cyanide 12.5 oz.; Sodium Hydrate 1.5 oz.

The throwing power of an acid solution was found to be very poor. The question immediately arose that if the throwing power of an acid zinc solution were so low, what was the structure of the electrodeposit and what was the influence of the addition of substances, or

If a plater runs his zinc solution at a definite current density for a stated time, in view of the data assembled, would he get the results expected? The effect of the composition of the plating solution is shown and there is only one conclusion, and that is,

Plate 5. Effect of Varying the Concentration of the Sodium Hydroxide and Sodium Cyanide

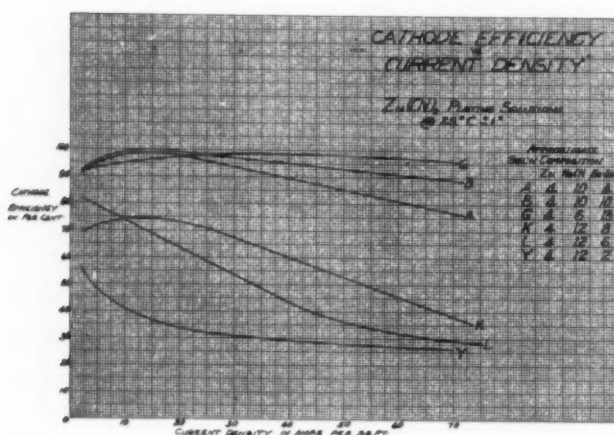


Plate 5. Fig. 1. Cathode Efficiency vs. Current Density

of any change in the composition of the solution? Time did not permit obtaining these data, but again the Bureau of Standards, through Dr. William Blum, came to my assistance. The effect of current density on both the surface and the crystal structure of the deposit is shown in Plate No. 6. The effect of pH and of the addition of dextrine on the structure of the deposit from an acid zinc solution was determined. (See Plate No. 7).

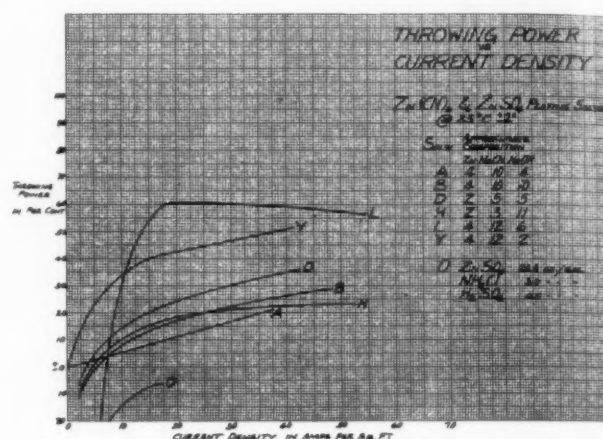


Plate 5. Fig. 2. Throwing Power vs. Current Density

that to obtain zinc deposits that will be fairly uniform all the ingredients of the plating solution must be kept within reasonable limits by periodic chemical analysis. Observation of the color or of the physical appearance of the deposit tells nothing. The thickness of the deposit must be ascertained if specifications are to be met, especially if the time of plating and the reading of the ammeter are depended upon to give the required results.

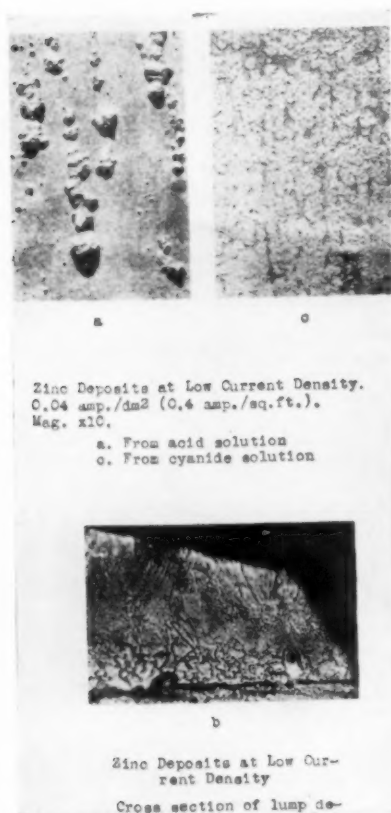
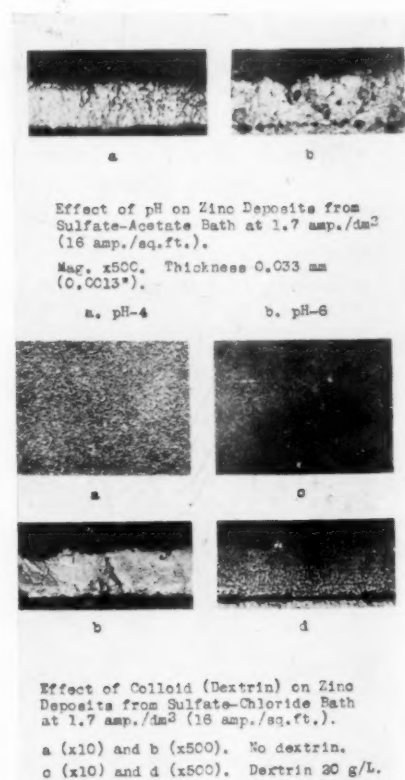


Plate 6.
Effect of
Current
Density on
Both Surface
and Crystal
Structure
of Deposit

Plate 7.
Effect of
pH and
the Addition
of Dextrine
on the
Structure
of the
Deposit from
Acid Zinc
Solution



There are two methods by which the thickness of an electrodeposit of zinc are measured—the microscope and the “Dropping Test.” As the structure of electrodeposited zinc is influenced by the composition of the solution, the pH value and the addition agents used, how do these two methods compare? It is well-known that metals having a different crystal structure are attacked by acids at a different rate. To obtain some light on this, steel cathodes 2" x 4" were plated for 15 minutes at 15 amperes per sq. ft. in solutions in which the composition varied as in the study of the structure of the deposit. As the cathodes were plated on both sides, and as there was an equal distance between each anode and the cathode, it was assumed that the structure was practically identical on both sides. Several measurements were made of the deposit on one side with a microscope adapted for measuring the thickness of electrodeposits of metal. The deposit on the other side of the cathode was measured by the “Dropping Test.”

It was found that in a “standard” solution the thickness of the deposit measured by each of these methods was within the range stated that would be had by previous investigators. From solutions in which the sodium hydroxide content was low, very thin deposits were obtained. This was what was expected as the data on the cathode efficiency predicted. An examination of the structure of the deposit also showed a distinct difference. There was also a greater percentage difference between the thickness of the deposit when measured by the microscope and when measured by the “Dropping Test.” This indicated that the percentage difference of the two methods depended upon the composition of the solution used.

While it is realized that there would be a thinner deposit from some solutions, it was not expected that the difference would be so great or that there would be such a contrast between the two methods used for ascertaining the thickness of the deposit. If there were such a difference in the cathode efficiency of solutions when measured by a coulometer, and, there were wide variations in the thickness of the deposit when measured by the two methods used, it was thought probable that the cathode efficiency could be determined by measuring the thickness of the deposit. It was recognized that there is a difference in the thickness of the electrodeposit on any article due to what is called the effect of local current density. The measurements of the thickness of the zinc deposit on the test plates used, due to the care used in plating, were very slight and, therefore, the average of several readings was thought to be representative and could be used as a basis for calculating the cathode efficiency. It is known that this cannot be done on all classes of work plated by production methods. From the electrochemical equivalents it was calculated that at 100% efficiency a deposit from a run at 15 amperes per sq. ft. for 15 minutes would be approximately .00028" thick. It was a simple matter to then cal-

culate the cathode efficiency of the solutions operated in this research. In all cases the efficiency indicated by the microscope measurements of thickness compared well with those obtained with a coulometer.

There was, as stated, a marked difference between the results obtained by the microscope and those obtained by the “Dropping Test.” An examination of the structure of the zinc deposit from solutions of similar composition clearly indicated that the rate of attack of the solution used in the “Dropping Test” was influenced by the structure of the deposit. The results are tabulated in Plate No. 8.

ELECTRO ZINC DEPOSITS					
DROPPING TEST - AND - MICROSCOPE MEASUREMENTS					
PIECE NO.	DROPPING TEST INCHES	MICROSCOPE MEASUREMENTS INCHES	COMPOSITION OF SOLUTION OUNCES/GAL. OR LBS.	CATHODE EFFICIENCY	
				DROPPING TEST	MICROSCOPE
1	0.00026	0.00021	1. ZINC CYANIDE 2. SODIUM CYANIDE 3. SODIUM HYDROXIDE	35%	77%
2	0.00026	0.00024	4 - 1.5 - 3.5	95	87.5
3	0.00028	0.00022	8 - 3 - 14	102	80.5
4	0.00028	0.00019	4 - 1.5 - 7	102	69.5
5	0.00084	0.00001	8 - 7 - 2	146	3.7
6	0.00002	?	4 - 3.5 - 1	73	?
7	0.00025	0.00025	8 - 7 - 7	91	91
8	0.00012	0.00013	4 - 3.5 - 3.5	44	47.5
9	0.00022	0.00027	8 - 3 - 7 + 10% NaCl	80.5	99
10	0.000006?	?	4 - 1.5 - 3.5 + 1	22	?
11	0.00024	0.00023	8 - 3 - 7 + 4	87.5	84
12	0.00001	0.00003	4 - 1.5 - 3.5 + 4	3.7	11
13	0.00033	0.00024	8 - 3 - 7 + 8	120	87.5
14	0.000005?	0.00003	4 - 1.5 - 3.5 + 8	180	11
15	0.00030	0.00033	8 - 5 - 11 - 20 AMP/30 FT. MAX. C.	84	90
16	0.00061	0.00047	8 - 5 - 11 - 40 AMP/30 FT.	83	64.5
17	0.00083	0.00069	8 - 5 - 11 - 100 AMP/30 FT.	69.5	57.5

ALL RUNS - 15 AMPS/SQ. FT. EXCEPT 15, 16, & 17 - TIME 15 MINUTES
HIGH & LOW CONCENTRATION RUN IN SERIES

Plate 8. Dropping Test and Microscopic Measurements

This work should be confirmed by other investigators. It is of importance to learn what influence the structure of the electrodeposit from any plating solution has upon the wearing qualities and its protective value against corrosion. If it is confirmed, then investigators in electroplating must take into consideration the efficiency of the plating solution in their research work. The plater must know the efficiency of the solutions used if he depends upon the reading of the ammeter and the time consumed when plating to meet specifications.

The Oldest Copper Roof

The oldest Copper roof, and probably the oldest roof of any kind in America, is the two hundred year old roof on Christ Church in Philadelphia. Many American patriots worshipped in this historic church, among them George and Martha Washington, Betsy Ross, Benjamin Franklin and Robert Morris.

Imitation Gold Finishes

By CHARLES W. HARDY
Industrial Consultant,
New York.

Finishes for Low Priced Novelty and Other Metal Goods.

SO FAR no one has discovered a substitute for gold that is cheaper, and until we do, all that can be done is to imitate it as nearly as possible. Not only is this true of the metal itself, but it applies to the art of electroplating as well.

Most platers with experience on novelty work can tell amusing stories of the many orders they have received that they must obtain a gold plate without the use of gold. True, we have dyes that penetrate the lacquered coating so that the color is close—but the finish including the coating does not last very long and few firms obtain good results over a period of time. Different colors, red spots, breakdown of lacquered coating, etc. are some of the main difficulties. To get fair results requires experience, close control, right conditions, good lacquer, right application, correct dye, etc.

A Good Imitation with Lasting Qualities

The easiest, cheapest and best imitation is to use a base metal of rich low brass—this is approximately 85% Copper and 15% Zinc. The metal is easy to fabricate, takes a good deep draw, forms and stamps easily and is generally carried in stock by the local warehouses, and if not, most of the brass mills are in a position to make quick delivery. This mixture of metal does not require an electroplate. During the last fifteen years the manufacturers of compact, vanity, lip-stick, mascara cases and containers have been large consumers of this specific mixture.

The major processes necessary to obtain various degrees of finish, fair, medium and good are as follows:

Matt, Satin and Brushed "Gold"

FAIR	MEDIUM
Matt Dip—Acid	Greaseless—Buff
Rinse	Clean { If surface is plain not
Dry	Dry { always necessary
Lacquer	Lacquer
GOOD	POLISHED GOLD
Cut Down—Tripoli	Cut Down—Tripoli
Potash—Cleaner	Potash—Cleaner
Greaseless—Buff	Color
Clean { Not always	Clean { Not always
Dry { necessary	Dry { necessary
Lacquer	Lacquer

The best lacquer I have found for rich low brass, either matt, satin, brushed or polished "Gold" is

a synthetic phenol resin of the heat polymerizing type. It is light amber in color and thin in viscosity and when applied over this alloy of copper it gives a richer gold color than a clear transparent film. Though the unit cost is much higher than a cellulose base lacquer the coverage is a great deal more; and in the final analysis it has been found cheaper per unit of article lacquered, and besides which it is odorless and is a much harder and has a much better "wearing" coverage. Tests have shown this lacquer to stand an abrasive test 6 to 7 times longer than cellulose base lacquers. Its few faults, however, are that it is much more brittle than the cellulose base material and it is a little harder to control its application to the base. Strides forward have been taken in the application by spray gun, but it requires an exceptionally good operator to apply it properly. On the other hand it is ideal for automatic dipping and baking. (See Automatic Dipping and Drying Lacquers, Enamels, Paints, etc.—July issue of **Metal Industry**).

Imitation Gold on Cold Rolled Strip Steel Articles

This has been applied on various parts such as hardware, bag frames, belt, dress and millinery buckles and ornaments, novelty jewelry, etc. (made of steel only and a combination of brass and its alloys, riveted, soldered, welded, etc.) for years very satisfactorily; but the control of the "Gold Solution" (bronze or rich low brass) must be done by a man who knows how. Temperature is an important factor and should be controlled by a thermostat otherwise trouble will be encountered and the plater is going to get the blame; the results might be all right for a while; but without an automatic control it just cannot last long. A formula for the solution that has stood the test is:—

Formula for Bronze Solution

Copper cyanide	4 ounces
Zinc cyanide	½ ounce
Sodium cyanide	5 ounces
Sodium carbonate	2 ounces
Rochelle salts	2 ounces
Water	1 gallon

Temperature 95° F; thermostatically controlled.

Cathode current density 2 to 2½ amperes per square foot; 2 to 3 volts.

Anodes: rolled 90% copper and 10% zinc; (sometimes referred to as rich low brass).

To replenish metal content, don't make a stock solution of copper cyanide, zinc cyanide and sodium cyanide. It is impossible to control the constituents in proper proportion to produce a uniform color in the deposit.

Separate stock solutions of the zinc salts and copper salts are better. They are prepared by dissolving equal parts of copper cyanide and sodium cyanide, and zinc cyanide and sodium cyanide in water and placing in separate containers until needed for adding to solution.

Rochelle salts are added when necessary to remove oxides by dissolving them from the anodes. This should be done when the deposit is not uniform. Don't add more than 1 to 2 ounces per gallon of water.

Some of the Troubles

During the extremely humid weather there is a tendency for the plate on satin or brushed work to "spot" (characteristic of any cyanide solution) and if this happens, your solution to the problem is to apply a light scratch brush operation with a thin crimped brass wire brush and fine powdered pumice. If on polished finish it generally is easily removable (if not too deep) by a light coloring operation.

Imitation Polished Gold

If some of the component parts are other than rich low brass it of course is necessary to plate the assembled units. Sometimes they are copper plated and sometimes brass, and in some cases copper plated and copper cut down, then flashed in brass and then bronze plated. If for polished "Gold" you must naturally

deposit more bronze than if for brushed finishes. After a heavy deposit of bronze use a small diameter good grade loose muslin buff with a red rouge and highly color and then lacquer.

Some plants have been producing articles of this kind for years with satisfactory, uniform results and have saved many thousands of dollars in gold by so doing.

Small Parts Tumbled

Many small parts and articles are highly tumbled by a cut down and then a good coloring tumble operation and then plated bronze in a basket in a still tank and then lacquered. The fine finish that can be obtained by this method is surprising, especially on small wire formed parts.

Remember, however, the finish before bronze plating must be the best you know how to get. If you want to, and the price will permit, use a few extra plating and tumbling operations, copper plate, either tumble or still. Then tumble and then brass plate and tumble, and then the bronze plate and another tumbling and lacquer. If this procedure is applied to steel the final lustre should be very good and a fine preventive against rust.

Try in a salt spray test or a 10% copper sulphate solution and be amazed at the low degree of porosity.

Each tumbling operation has a tendency to "pein over" the metal and fill up the pores of its surface which we know is a rust preventive in itself; beside which it forms a smooth top surface generally referred to as a "metal skin" which results in a good final lustre and finish.

Iron Pot for Zinc

Q.—We are having difficulty melting zinc in an iron pot. The zinc absorbs an appreciable quantity of iron from the pot and we wonder if there is any procedure we might follow, which would eliminate this condition.

Is there some metal with which the pot could be lined? Is there some special composition of ferrous base metal from which a pot could be cast without resorting to the use of rather expensive special alloys?

A.—The best type of pot to use for melting zinc is a steel pot either cast or pressed. Pots made of welded boiler plate 1" to 1½" thick have been found excellent. This type of material resists corrosion or solution by the melted metal better than any other.

It is important also that the metal should not be overheated—800 to 825 degrees F is a good range of temperature. The furnace should be of such construction that there is no local overheating. If the flame impinges on the pot in any one place, a hot spot results, and the pot is attacked by the overheated zinc.

The pot should be heated around the sides rather than at the bottom.—Sam Tour.

Cement for Brass

There are several cements for brass. The one to use will depend upon the temperature and the permanence required by the service. The size of the pieces and their numbers also are important. Low melting solders are available and these are permanent. They can be used at temperatures below boiling water. Shellac will serve where the pieces are not subject to much heat or shocks. Warm the pieces and coat lightly each surface. Leave exposed until most of the alcohol has evaporated, and then put together with a sliding movement and leave under pressure for a while. Rosin, slightly applied to heated surfaces, will form a good cement.

For most metal to metal cementing, the bakelite compounds are also good.—W. B. Francis.

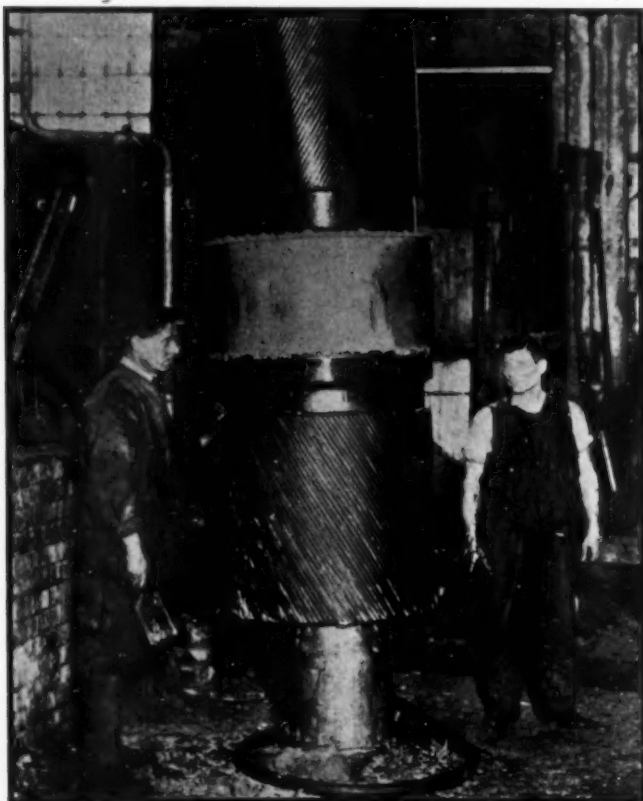
The Plater Turns His Hand to Heavy Parts

By G. F. GEIGER

Development and Research Department,
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Inc., New York.

NICKEL plating generally is thought of as a thin deposit of nickel, rarely over .002 of an inch in thickness, used chiefly for appearance or for protection against corrosion. Although this is generally correct, a process has been developed in Great Britain during the past 15 years in which heavy nickel deposits are used to build up worn or undersized metal parts. Known under the trade name of "Fescolizing,"¹ this process has been applied to heavy as well as small equipment. As this process has not

¹The Use of Nickel Deposits for Engineering Purposes, by C. H. Faris. Institute of Engineers and Ship Builders in Scotland.



This second reduction, turbine gear shaft weighing 8½ tons indicates how nickel plating can be utilized to build up worn sections. The Fescol process deposited the nickel coating in the center

Electro-plating is proved Efficient and Economical in Building up Worn Sections of Big Equipment. Method Has Advantage of Application at Room Temperature.*

been patented some details employed abroad have not been revealed. Some progress in the development of a similar process has been made in this country.

"Fescolizing" has been applied to carbon and alloy steel, case hardened steel, cast iron, malleable iron, as well as the ordinary brasses and bronzes. It is also possible, when required, to build up nickel on such alloys as stainless steel and Monel. The greater part of the work is, however, on steel.

The part to be salvaged is first thoroughly cleaned to remove all traces of oil or grease. Since it is seldom that the whole article is to be built up, it is next dipped in a tank of molten low melting point wax and upon removal carries a film of wax all over the surface. The wax is carefully removed from the part to be built up and the exposed area is cleaned in an electrolytic cleaner which removes foreign matter and traces of oxides.

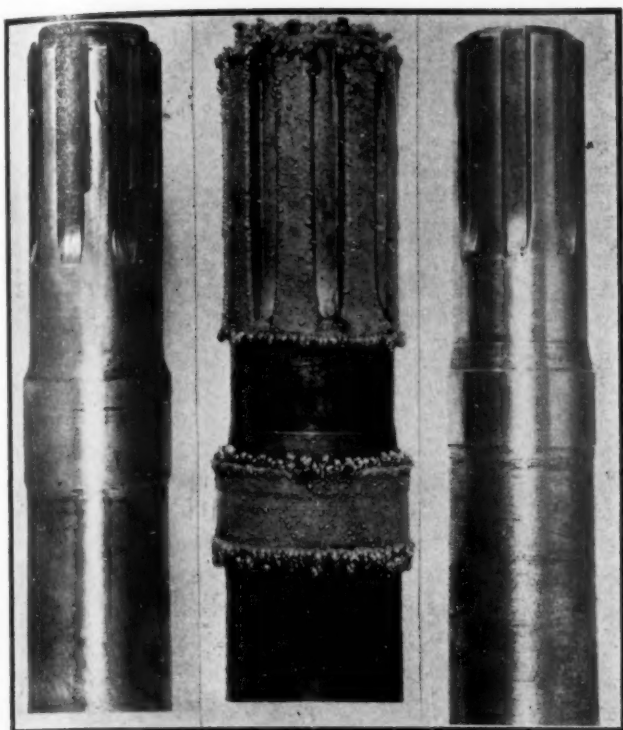
The electrolytic cleaning operation, upon which the bond or adherence between the nickel and the basic metal greatly depends, must be carried out with great care. It is claimed that properly cleaned surfaces will give a bond between iron and nickel equal to the strength of the metals. The cleaning operation is followed by a rinse and, while still wet, the work is placed in the plating tank.

The plating operation is conducted cold, about 80° F., in still tanks which will accommodate machine parts weighing up to two tons, depending, of course, upon their shape.

The time required for deposition will depend upon the thickness desired and several days are sometimes required. Deposits are usually in the order of a few thousandths, but if necessary, may be built up to half an inch. High purity anodes, over 99 per cent nickel, are required.

After plating, the wax is removed by immersion in hot water, and the built up area machined or ground to size. For lathe work, the proper tool angles must

* From Inco, Vol. XIV, No. 3.



These three views show a spline shaft as worn, after being built up with nickel, and as machined and finished. The center photograph has been slightly enlarged with reference to the other two

be used to prevent tearing of the nickel. In some cases, grinding has been found advantageous.

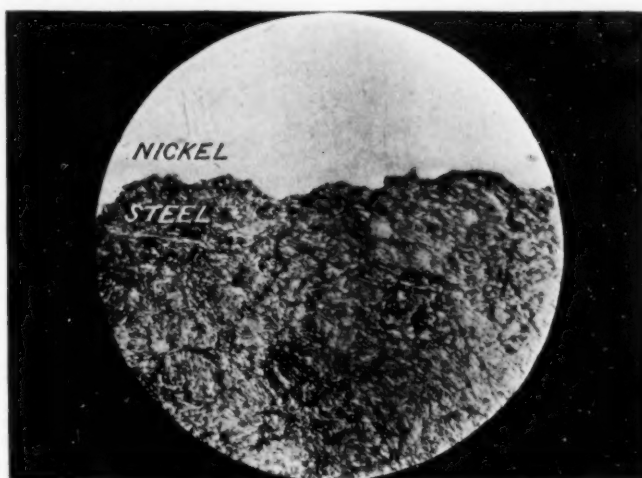
The process holds definite advantage for engineers because it is carried out at room temperatures and thus does not set up local stresses that may, in turn, cause distortion.

Nickel deposits may be varied in hardness up to 60 Scleroscope and, therefore, require no heat treatment.

Restored parts offer favorable comparison with the

original material. They remain bright and clean in storage and when exposed to any alkaline solutions or many acid and salt solutions, the nickel surface effectively resists corrosion. Numerous plant tests on crank shafts, pump shafts, impeller shafts, valve spindles, splines and such parts have shown the wear resistance of the deposited nickel to be better in many cases than the underlying original metal.

In the power field especially considerable saving has been effected by restoring worn parts which were then replaced in service in super-heated steam at 800° F. The highest temperature to which rebuilt parts have been subjected is approximately 900° F. It may be found that they can be used at even higher temperatures. The coefficient of expansion of nickel



Photomicrograph x 250 of electro-deposit of nickel on steel

and steel are so nearly the same that no difficulty has yet been experienced due to the slight difference which does exist.

First Aid to Water-Logged Electric Tools

John S. Hand, Service Manager of The Black & Decker Mfg. Co., Towson, Md., has offered the following suggestions to electric tool users whose equipment may have been under water during the recent floods in many areas of the Middle West.

Submersion has probably ruined the insulation in the tools as well as rendering the fibre parts unfit for use. Grease has become diluted and dirty and all parts covered with silt and mud.

Do not operate electric tools, motors or switch mechanisms until they have been taken down, cleaned and baked out.

For best results, send the tools to the nearest factory service branch for overhaul by trained men.

Where owner desires to service the tool himself, the following procedure is suggested.

Completely disassemble the tool, to get to all parts. The armature and field should be put into an electric

oven and baked for twenty-four hours at a temperature of 275° Fahrenheit.

They should then be checked for shorts and grounds. If O.K., apply a coat of insulating compound and bake again for 12 hours at 275° F.

All fibre switch and brush riggings should be replaced. Most switches will have to be replaced and all taped wire connections should be cleaned and re-taped.

Clean all ventilating holes in the case of the tool.

Wash all grease from all gears, housings and bearings, using a suitable fluid. Repack with new lubricant, using a good grade of medium cup grease, such as "Non-Fluid Oil A-No. 3" or equal.

Clean rust and dirt from all parts.

These instructions apply to electric grinders (portable and bench), sanders, polishers, drills, screwdrivers, hammers, heat guns, saws, valve refacers and, most types of motor driven electric tools.

What Is Lacquer?

By GUSTAVE KLINKENSTEIN*

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THE word "lacquer" has been applied to three quite different types of finishes, so that there is at times some confusion as to its exact meaning.

The word itself comes from a Hindu word, which we spell "lac" and means 100,000, or any great number (as in the phrase, familiar to readers of Oriental tales, "a lac of rupees"). But "lac" is also used to refer to a minute scale insect which covers the twigs of certain trees in India by the thousands and, again, to a curious resinous substance secreted copiously by these insects. This resin, when refined, is shellac, so that "lacquer" was originally a shellac varnish.

Another type of "lacquer," made from the sap of an oriental species of sumac, has been used for thousands of years by the Japanese and Chinese for their often exceedingly beautiful lacquerware.

But to the modern industrial finisher, "lacquer" is neither of these things. It is a finish consisting of nitrocellulose dissolved in a volatile solvent, with or without pigments and other substances.

Nitrocellulose (or pyroxylin) is used by industry in a number of different forms. Gun-cotton, which has a high nitrogen content and limited solubility, is used in making explosives; while celluloid, photographic films, collodion, a type of artificial silk, and lacquers are compounded from low nitrogen content varieties, designated as "soluble cotton." Products finished with a nitrocellulose lacquer are, therefore, covered with a coating that resembles celluloid.

How Lacquers and Varnishes Differ

Varnishes and enamels (which consist of varnishes containing opaque pigments) superficially resemble lacquers, but actually they are quite different. A varnish consists of a resin dissolved in a vegetable drying oil and thinned to the consistency of a liquid with a volatile solvent. It dries, first, by the evaporation of the solvent and, secondly, by the oxidation of the oil, whereas a lacquer dries only by the evaporation of the solvent.

This difference in the drying characteristics of the varnish and lacquer groups is of great practical impor-

How Lacquers and Varnishes Differ; the Advantages of Lacquer; Fitting the Lacquer to the Job; Cooperation Essential Between Lacquer and Product Manufacturer.

tance to the industrial finisher. Lacquers air-dry very rapidly and quickly become hard enough to withstand handling. Varnishes, however, air-dry slowly, usually remaining tacky for many hours, and when they are applied to industrial products, they are often baked to speed up the drying process and produce a more durable film.

As a matter of fact, the two groups have merged into each other. There are quick drying varnishes and enamels, and lacquers that are ordinarily baked. But aside from such borderline products, the broad distinction between the drying rates of the two groups hold good for the great majority of these finishes used in industry.

It is only in recent years that the lacquers came into general use for industrial finishing. Prior to 1923, the varieties of nitrocellulose available for lacquer making formed such viscous solutions that they could not be used in concentrations exceeding 5%. The films formed by these lacquers were thin, and while suitable for protecting polished brass, silver, and other metal surfaces from corrosion, their applications were otherwise rather limited. Since 1923, however, varieties of nitrocellulose have been developed of such low viscosity in solution that they can be used in concentrations up to 25%. This development immensely extended the usefulness of lacquers, and quickly revolutionized the finishing of automobiles and countless other industrial products. For a while, in fact, it seemed as though lacquers would completely displace varnishes and enamels for industrial finishing. However, as often happens in such cases, corresponding developments took place in the older field, and varnishes and enamels are still widely used by industry.

The Advantages of Lacquer

The chief advantages of lacquer are:

1. The protective and decorative film hardens rapidly and completely without the application of heat.
2. The film has great mechanical, chemical, and atmospheric resistance.
3. The film can be so clear that it is invisible and reveals only the surface it covers, or it can be colored with transparent or opaque pigments.

* For a biography of Mr. Klinkenstein see p. 137 of this issue.

4. The lacquer manufacturer can, by the use of various substances, vary at will and over an exceedingly wide range all of the chemical and physical properties of a lacquer and of the film that it forms, so that he can supply a lacquer for a given product that will be exactly suited to:

- A. The material of which the product is made.
- B. The service to which it is subjected.
- C. The process of manufacture and the finishing facilities available.

Fitting the Lacquer to the Job

This last point, "property control," has assumed great importance in recent years. Because of its possibilities, few modern lacquers are simple nitrocellulose solutions; the great majority are complex compounds made up of a variety of ingredients. Chemists have been busy developing new raw materials for lacquer manufacture, and today there are literally thousands of them—lacquer bases, solid and liquid "plasticizers," natural and synthetic resins, pigments, solvents and diluents—each of which has some special influence on the qualities of the lacquer in which it is used.

By properly combining these materials, the lacquer chemist can produce lacquers with films that are thick or thin, hard or flexible, tough or soft, with high, medium, or low gloss or no gloss at all, and with other characteristics demanded by the requirements of the product to be finished.

These requirements are usually much more complex than the average person realizes. Thus, every metal and alloy has its own individual chemical and physical properties, and so, too, have the products of oxidation and corrosion formed on each metal. If a lacquer used on a given metal is not properly formulated for that metal, it may not adhere well or it may be quickly destroyed by chemical reaction with the metal's corrosion products. Certain metals, such as aluminum, cadmium, zinc, and chromium present special finishing difficulties, some of which have only recently been overcome. Electroplated metals invariably carry traces of the bath chemicals and these have to be counteracted by the lacquer or they will cause spotting. In general, therefore, there is a special lacquer for every kind of metal used by industry.

But the kind of material to be finished provides only one factor of the lacquer formulator's problem. The character of the surface—whether smooth, rough, compact, or porous—influences the lacquer formula. So, too, does the design of the product—a lacquer that works well on a smoothly rounded article may not be suitable for one with sharp points or edges or deep machining.

Service requirements vary widely. Many products are normally subjected to rough handling, to moisture, to weak acids, alkalies, or other chemicals, to household cleaners, alcohol, fruit, juices, and grease, to

high or low temperatures, and to various combinations of these and other conditions. Lacquers can now be produced with astonishing wearing qualities under the most adverse conditions, but the lacquer formulator must know in advance what conditions have to be met and develop a lacquer to fit each particular case.

In the matter of color, the lacquer maker knows no limitations. He can reproduce any color or color combination known to man, including the brilliant metal colors produced chemically and the subtle tones of some of the "lost" decorative arts of the ancients. What is more, he can produce color and decorative effects never before seen on land or sea.

Of special importance in the preparation of a lacquer for a given product is the process by which the product is produced. Here, skill in lacquer making means dollars and cents to the product manufacturer, for, if the finish is not accurately "geared" to the process, if it causes unnecessary delays or complications anywhere along the line, the production costs per unit may greatly increase. Among the points that have to be considered in this connection by the lacquer formulator are: the method by which the lacquer is to be applied—whether by brushing, dipping, spraying, or machine coating; the character of the finishing skill and equipment available or advisable; the possibilities of eliminating one or more coats or bakings; the optimum drying rate for each coat; and the degree and character of the processing or handling of the product or its materials after finishing.

Cooperation Between Lacquer and Product Makers Essential

Because the lacquer maker has such effective control over his products, he has increased the attractiveness and durability of industrial finishes and has decreased the finishing cost per unit. But satisfactory results can only be secured through the closest cooperation between the lacquer maker and the product manufacturer. The lacquer maker must make a thorough study of the product to be finished; he must almost invariably develop special formulae to suit it; and he must carefully test his finishes in his laboratory before permitting their use in production. On his part, the product manufacturer should consult the lacquer maker at the earliest possible time and not wait until all other details are settled before taking up the problem of the finish.

Furthermore, a lacquer developed for one purpose should not be used for another, even though the two applications seem similar. The chances are that the lacquer will not be exactly adapted to the second product and that trouble may ensue. Reliance on the services of the lacquer maker in all matters pertaining to finishing is one of the requisites to the successful use of lacquer finishes in mass production.

Synthetic Lacquers

By A. O. PLAMBECK

Technical Director, H. V. Walker Co.,
Elizabeth, N. J.

One of the Newest Developments in Metal Finishes.

EVER since the popular acceptance of pyroxylin lacquers in the manufacturing industries, both the users of lacquers and the lacquer manufacturers have made increasing efforts to effect improvements in this type of material. The metal industries were the first to recognize the merit of pyroxylin or nitro-cellulose lacquers, and thus were in an excellent position to suggest ways and means for affecting further improvements in this versatile coating. Some of the characteristics in which it was found that the early lacquers were not 100% satisfactory, were in adhesion to certain types of metal, such as smooth plated ware, and later with the advent of chromium and cadmium plating, it was found that these metals also offered an additional adhesion problem for lacquer finishes. In addition to adhesion, in many cases it is desirable to have greater resistance to acids, alkalis, and chemicals, as well as less discoloration from heat and light. Alcohol resistance is another desirable feature for certain applications, and the production of an alcohol resistant coating which would have the other essential features of a commercial finish has been the subject of extensive research in many laboratories.

A finish which would withstand all of these destructive chemicals would be welcomed with open arms by not only the metal industries, but also electro-plating shops, process industries, machinery and equipment manufacturers, and thousands of industries making novelties, household utensils, kitchen equipment and many other products subjected to the effects of chemical corrosion. Several years ago such finishes were not obtainable, and even today there is no one finish available which will meet all the above conditions. However, thanks to the recent developments in synthetic chemistry, and particularly in synthetic resins, there are finishes commercially available which meet one or more of the above requirements to the satisfaction of the manufacturer and the consumer.

The word "Lacquer" in connection with finishes, in general refers to a liquid coating, which when applied in thin film on the surface of an object, dries rapidly forming a hard, tough, protective coating. While the term "Lacquer" is often used in connection with oleo-resinous materials, particularly of the baking type, it is more commonly thought of as referring to the pyroxylin type of coating material, and it is this type of lacquer which will be discussed principally in this article.

As is generally known, the chief ingredients of pyroxylin lacquers are as follows:

- Cotton or nitrocellulose (pyroxylin)
- Gums
- Plasticizers
- Oils
- Solvents (for cotton)
- Diluents (solvents for gums)
- Pigments (in the case of colored lacquers)

Since the solvents and diluents are volatile, and leave the film during the setting up or drying process, it is easily understood that these ingredients of the lacquer have little or no influence on the film characteristics, except perhaps indirectly. By this we mean that the chief constituents which influence the film characteristics are more likely to be those which make up the solid or non-volatile part of the film, such as the cotton, gums, plasticizers, oils and pigments. The solvents do play some part in the film formation, as a properly balanced solvent blend will leave a film with a continuous solid and non-porous structure, where an improper solvent combination is apt to cause partial precipitation of one or more of the constituents, which would result in the formation of a porous or spongy film. This type of film would not show to advantage the desirable qualities of some of the solid constituents, which may have been carefully selected for certain properties of adhesion, chemical resistance and film strength. Thus it is well worth remembering to keep a well balanced solvent combination in any lacquer, and particularly in the lacquer thinner, when maximum desirable qualities are wanted in the finish. It happens altogether too often in many shops that an excellent lacquer is spoiled, or is not given an even break, by using too cheap a thinner, thus producing a mediocre job where for a few cents more, by using a first grade thinner, the film would be deposited on the job in the proper state of continuity for which it was designed.

Granting that the solvents have some influence on the film characteristics, we have to go still further to find how lacquers have been improved. In the old days it was generally found that high cotton content lacquers were the best from the standpoint of toughness, chemical resistance and general durability. But with ever increasing demands for better adhesion, it was found that with an increase in gum content there was a marked improvement in the adhesion, par-

particularity to metals. The plasticizer and oil content were also found to have considerable influence on the adhesion of lacquers to metals, so that the best metal lacquers were those with well selected blends.

Some very fine metal lacquers have been made and widely distributed which have appreciable amounts of gums of the natural or fossil type, such as dammar, elemi, copal and ester, but none of these have been entirely satisfactory where extreme conditions of adhesion, chemical resistance, alcohol resistance and outdoor durability were desired. Lacquer manufacturers were among the first to experiment with synthetic resins, and the development of these resins has played an important part in the improvement in lacquer finishes. Synthetic resins are now available which can be blended with cotton lacquers to form a synthetic lacquer with hitherto unheard of properties. A wide variety of these resins are now on the market, and they vary all the way from hard brittle types with extreme acid and alkali resistance, to soft plastic types with excellent qualities of adhesion, film strength and elasticity. Some of these resins are of such nature that they undergo no chemical change in the film forming process, and merely remain in solid solution in the film to impart their characteristics, usually in the case of the hard resins, quick drying, hardness, toughness, chemical and alcohol resistance, high lustre. Other resins of the softer or plastic type, undergo a chemical change on baking the film, which results in greater adhesion, elasticity and toughness.

The use of these synthetic resins in lacquers also has the advantage of allowing higher solids at spraying consistency, which means lower finishing costs. In the case of pigmented lacquers or lacquer enamels, these also can carry higher pigment concentration at spraying viscosity, so that a one coat synthetic lacquer is available, which has better adhesion, chemical resistance, durability than the old type of finish which required in some cases a three coat system, made up of primer and two coats of lacquer enamel.

Since most of these characteristics are due to the high amount of synthetic resin in the lacquer, best results can be secured when the maximum amount of resin is carried along with the nitro-cellulose. The plastic baking type of resin particularly lends itself to advantage in this type of product. Baking synthetic lacquers have some unusual features, they dry to touch or handle in approximately fifteen to thirty minutes, after which a second coat can be applied if desired; then the job is baked from forty-five minutes to one-and-a-half hours at a temperature of from 250° F. to 300° F. depending on the color and type of finish.

Pigments have also been improved, so that a much higher degree of color stability is found in present day lacquers, particularly where chemical and light resistance are required. Black and the darker shades of green, brown and gray are still best where great permanence of color is desired, while the lighter and

pastel shades still present their difficulties. In general, the metallic pigments are superior to the chemical pigments in resistance to acids and alkali, as well as resistance to ultra-violet light rays and exterior exposure. Pure or 100% colors are also generally more durable than mixed or let down colors, as a normally durable color will often be found to fade rapidly when used in a tint, or mixed color. Of all colors, black is most durable, as has often been noticed in the case of automobiles and other articles subjected to severe service conditions. Among other colors, chromic oxide, available in various shades of green is one of the most permanent colors available.

From the results of these developments in synthetics, solvents and pigments, it can be seen that a new type of coating has been made available, with important new characteristics not found in the old type of pyroxylin lacquer or in the newer baked or air dried synthetic enamel. Because of the content of nitro-cellulose, these materials set up rapidly, permitting handling of the finished object in a few minutes, or if desired the second coat can be applied in a short time, about five or ten minutes after the first coat, then the finish is ready for baking. The high amount of synthetic resin in the lacquer gives much greater toughness, adhesion, flexibility and longer service life, particularly when subjected to a long high bake, such as one or two hours at 300 degrees Fahrenheit. Such a finish contains a substantial amount of a tough, plastic and flexible resin, which also acts as a partial solvent and plasticizer for the nitro-cellulose and holds it in a stable solution. Where a straight cotton lacquer would break down and begin decomposition at such a bake, this new type of lacquer secures its maximum durability and toughness through the baking process.

This type of baked finish is almost inert chemically, which means that ordinary acids, alkalis, plating solutions, etc. have little or no effect. Ultra violet rays and sunlight, which are among the most destructive agents to ordinary finishes, also do not readily affect this synthetic lacquer, due to the protective action of the durable synthetic resin contained therein. This type of vehicle also has the capacity to carry a higher pigment and solid content at spraying viscosities, which enables the user to get greater coverage in fewer coats, in some cases one coat covers as well as two of the old type lacquers, so this feature must be kept in mind in any comparative cost figures.

This new type of finish will no doubt find widespread usage and applications. It has already been adopted by a number of wide-awake and progressive manufacturers, of such articles as electrical appliances, jewelry novelties, cigarette cases, vanity cases, automobiles, radio parts, vending machines, office equipment and other metal products. Manufacturers who are on the lookout for ways to improve the appearance and serviceability of their products will find it well worth while to make comparative tests of this new type finish against what they have been using in the past.

Editorial Comment

Copper Enlists for War

DURING the last two weeks of February the copper market was entirely disrupted by speculative excesses. The European price for copper has been consistently ahead of American for months. From time to time American producers have increased their prices to resume their normal position, with American copper selling above foreign due to our 4c duty; but almost immediately after each rise in American copper, speculation abroad has "raised the ante" forcing American producers against their will to post further increases. As a result, American copper has risen from 9¼ to 15c, official, within the past six months.

To credit this vertical ascent entirely to speculation would be misleading. Speculation cannot exist for long periods without some basis in fact, and the facts are now coming to light. The fundamental reasons for the sky-rocketing market in copper are:

1. Steadily increased consumption by industry.
2. Steadily declining stocks of refined copper in the United States and relatively small increases in stocks in Europe in the face of large increases in production.
3. Buying by foreign governments or armament firms for munitions to supply the tremendous program of armament building which is sweeping Europe.

At the time of writing, with American copper officially at 15, actual sales are being consummated as high as 16c for immediate delivery. The price of export copper is 16.05 cif. Hamburg. Even casting copper is selling at 15.75.

Obviously this condition cannot be anything more than temporary. Foreign copper must drop below American or American copper step above foreign. If the latter takes place, foreign demands may drive the price up again. How far? No one would risk a prediction.

Most of the American copper and copper base alloy fabricating concerns are already owned or controlled by the producers, and for that reason their needs will be supplied. Independent fabricators, however, may find themselves in a serious position if the present condition continues.

Is our present import duty on copper helping the industry? Is it at all effective? Would its removal make any difference? What shall the public utilities, our largest individual consumers who have been taking comparatively little metal as yet, do when it is

necessary for them to obtain large supplies, and what shall the industry do to supply them? These are more very serious questions.

We are definitely faced with the fact that, whether or not war actually comes, copper has enlisted.

Platers Will Convene in New York

THE Annual Convention of the American Electro-Platers' Society for 1937 will be held from June 14 to June 17 in New York, with headquarters at the Pennsylvania Hotel. While no detailed statements are available at this time regarding the program, entertainment and other plans, it is definitely in order to remind our readers to set aside this week for a convention trip and a visit to the Big Town.

It is no part of our function to praise New York. She needs none. We only refer our readers to the announcement of the Society (on page 135 of this issue) and urge them to begin to lay plans now, to have their affairs in such shape that they can attend the convention.

Detailed information regarding the progress of the convention plans will appear regularly in our issues from now on.

Business Marches On

FEBRUARY is always a comparatively quiet month, consisting largely of preparation for the Spring trade. Nevertheless, according to the Cleveland Trust Co., general business activity is now not far from 20% above its levels of a year ago. Some slowing down was caused by floods and strikes but recovery is advancing with sustained vigor. Improvement has also included the heavy industries such as steel, machine tools and building and is definitely reducing unemployment.

The same is true abroad as well as in this country, but it must be borne in mind that a large part of the improvement abroad can be credited (or debited, depending upon the point of view of the individual) to munitions. Our expenditures for such purposes have not risen to unusual proportions and our recovery is consequently sounder.

At this moment the prospects for Spring business are very fair.

New Books

Aluminum Paint and Powder, by Julius David Edwards. Published by the Reinhold Publishing Corp., New York. Size 6 x 9; 216 pages. Price \$4.50.

This book is the second edition, revised and enlarged (the first edition, entitled "Aluminum Bronze Powder and Aluminum Paint"). The author who is assistant director of research of Aluminum Co. of America, wrote the first edition nine years ago. Increased knowledge of materials and applications in the interim, have necessitated the new work.

The book includes material on the new methods of manufacture, new methods of testing, vehicle formulation for aluminum paint with special attention to the use of synthetic resins and also the behavior of aluminum paint films on wood and metal.

Chapter headings are as follows: Manufacture of Aluminum Powder; Some Properties of Aluminum Powder; Examination of Aluminum Powder; Composition of Aluminum Paint; Aluminum Paint in the Protection of Metals; Special Properties and Use of Aluminum Paint; Aluminum Paint in the Protection of Wood; Aluminum Powder in the Arts; Appendix; Indexes.

How to Find Metallurgical Information, by Richard Rimbach, Pittsburgh, Pa. Size 9 x 12, 32 pages. Price \$1.00.

As the author says there was a time when a specialist could hold all the material on his subject in his mind but that time has passed forever. Today he is not only unable to keep it in his mind, but he may even have trouble knowing where to go to find it.

The author lists the various sources of metallurgical information, such as handbooks, bound volumes, periodicals, company literature, Government publications, patents, specifications, etc. He gives a complete list of handbooks of metallurgical interest, metallurgical books in print, a list of publishers, a special index to books and a list of metallurgical periodicals.

This is an extremely valuable little work.

Symposium on Radiography and X-ray Diffraction Methods. Published by American Society for Testing Materials. Size 6 x 9, 425 pages. Price \$4.00.

This collection describes modern methods and equipment in an elementary way to assist industries in the application of x-rays to their work. It presents many case histories of successful applications and compares usefulness of x-ray methods with the usefulness of other methods which may be used as alternatives.

Journal of the Institute of Metals (Great Britain). Published by Institute of Metals. Size 5½ x 8½, 325 pages. Price £1, 11s, 6d.

Volume 58 No. 1 of the Proceedings for 1935, covering the papers read at the Spring 1935 meeting.

Technical Publications

Tinplate and Tin Can Manufacture. A survey of American methods. Bulletin 4 of the International Tin Research and Development Council; 144 pages, 10½" x 8¾", 159 illustrations. Issued free by the International Tin Research and Development Council, 149 Broadway, New York.

This bulletin has been prepared by the staff of the Battelle Memorial Institute, Columbus, Ohio, in collaboration with the leading American technicians. Apart from detailed descriptions of methods and machinery used in making tinplate and tin cans, there are chapters devoted to the field of tinplate cans and containers, history of the industries, statistics, tinplate lithographing and the future prospects for improvements and new applications.

Production of Black Anodic Coatings on Tin.

Some time ago the International Tin Research and Development Council developed a method of producing colorless films on tin by an anodic process. Like the corresponding films on aluminum these films are capable of being dyed in various colors and have decorative possibilities. The Council's Director of Research, D. J. Macnaughtan and Dr. R. Kerr have extended this work and describe in Technical Publication, Series A. Number 48, how black films may be prepared without recourse to dyeing.

The tin or tin alloy article to be coated is made the anode in a hot solution containing trivalent or quadrivalent anions such as phosphates or ferricyanides using high current density. About six minutes' treatment at 90° C suffices for a satisfactory blue-black coating on an article of simple contour. The decoration is also suitable for tinplate or pewter and the report includes some illustrations of designs in black and white produced on pewter by this method.

Copies of the above publication may be obtained free of charge from the International Tin Research and Development Council, L. J. Tavener, U. S. Representative, 149 Broadway, New York City.

Depreciation Reserve Policies. Timely recommendations based on exhaustive study by the Machinery and Allied Products Institute, 211 N. La Salle St., Chicago, Ill.

Spectrographic Analysis of Tin, by D. M. Smith. Published by the International Tin Research and Development Council, 149 Broadway, New York.

High Tensile Strength Brasses or Manganese Bronzes. A metallurgical review of their properties and uses by H. J. Miller (reprinted from Metal Industry of Great Britain, August 28 and September 4, 1936). Published by Copper Development Association, Thames House, Millbank, London, S. W. 1, England.

The Retarding Effect of Stannous Salts on the Oxidation of Olein and Oils, by Dr. Ir. S. H. Bertram. Published by International Tin Research and Development Council, 149 Broadway, New York.

Correlation Between Metallography and Mechanical Testing, by Herbert F. Moore, Engineering Experiment Station, University of Illinois, Urbana, Ill. Price 20c.

Preparation of Tin and Tin Alloys for Microscopic Examination, by H. J. Taffs. International Tin Research and Development Council, 149 Broadway, New York City.

Government Publications

Hack-Saw Blades. Simplified Practice Recommendation R90-36, Superseding R90-29. Obtainable from Superintendent of Documents, Washington, D. C., for 5c.

Bureau of Mines Statistical and Economic Surveys Metal Economics Division; Advance Summaries: Zinc Industry in 1936; Copper Industry in 1936; Lead Industry in 1936; Cadmium Industry in 1936; Aluminum in 1936.

Trade Practice Rules for the Mirror Manufacturing Industry, promulgated by the Federal Trade Commission, Washington, D. C.

Structural and Ornamental Iron Work. Census of Manufactures 1935. Department of Commerce, Washington, D. C.

Analysis of State Unemployment Compensation Laws. Unemployment Compensation Circular No. 2. Social Security Board, Washington, D. C. This analysis contains the most significant provisions of state unemployment laws as interpreted by rules and regulations made by the state agencies administering them.

Lead, by Elmer W. Pehrson and H. M. Meyer. Chapter from Minerals Yearbook 1936. U. S. Bureau of Mines, Washington, D. C.; obtainable from the Superintendent of Documents, Washington, D. C., price 5 cents.

Industrial Property Protection Throughout the World, by James L. Brown, Division of Commercial Laws, Department of Commerce, Washington, D. C. Obtainable from the Superintendent of Documents, Washington, D. C., price 20c.

Shop Problems

Questions from Readers Relating to Shop Practice and Answers by our Associate Editors.

Foundry
Mechanical
Metallurgical
Rolling Mill

Electroplating
Polishing
Metal Finishing
Reclamation

Blistered Plates on Radiator Grilles

Q.—We are plating grilles for automobiles and the operations are as follows:

Rinsing in a solvent, then in gasoline and without drying in sawdust; placing the grille in the cleaner. Quite a lot of oil collects on top of the cleaner. Then the grille is given the usual acid rinse (10% H_2SO_4), then water rinse; then placed in cyanide copper bath and given a good heavy coat of copper. From there we give the grille a water rinse and place in a bright nickel solution.

Could you suggest a good or better method of plating a die cast grille (zinc)? We do not want to scrub the grilles, yet we are running up against quite a bit of blistering. Could you tell me the best method known of plating zinc die cast grilles on a production basis? Do you think most of our trouble lies in using the solvent and gasoline rinse method of cleaning?

A.—The blistering of the grilles is due to improper cleaning of the metal.

If the grilles are not oily or greasy there is no need for the use of solvent or gasoline. Use instead an electric cleaner composed of:

Trisodium phosphate	2 ozs.
Soda ash	2 ozs.
Water	1 gal.

At least 180 Deg.

Direct current for $\frac{1}{2}$ to 3 minutes. Rinse in warm or hot water, then cold water, then direct in the cyanide copper. Some platers prefer to give the work an etch in 10% muriatic acid before going into the copper solution, but if possible this should be omitted. The use of the acid dip will depend to a large extent on the condition of the die cast surface, i.e., whether it has a passive skin or not.

If the grilles are greasy a solvent must be used and the best method is by means of vapor degreasing in a standard degreasing machine. If this is not available the grilles can be immersed in solvent or gasoline as you are now doing, but after this they must be dried off well in sawdust. The solvent cannot be removed thoroughly by immersion in an alkaline cleaner as you are now doing.

After the solvent clean it is better to use a regular soap cleaner such as can be supplied by any of the cleaner houses. After this, rinse, and then clean in the electric cleaner as given above and follow through as above.

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Peeling may also occur on work of this nature if the free cyanide content of the copper solution is too high. However, it is believed that in your case the cleaning is faulty.

—G. B. H., Jr., Problem 5,559.

Blue on Brass

Q.—Please send me information on a bluing process for brass.

A.—A blue on brass can be obtained with the following solution:

Sodium thiosulphate	50 grams
Lead acetate	25 grams
Water	1 liter

Use at 160-180 deg. F.

In order to obtain a satisfactory blue on steel a heat process is necessary.

—G. B. H., Jr., Problem 5,560.

Blue on Steel

Q.—I am very much interested in the field of bluing steel. I would like to get a formula for making a solution for this work.

A.—Directions for obtaining a gun metal blue, with composition of the bath used is given on page 36 of the Platers' Guidebook, 1936 edition, published by Metal Industry.

—G. B. H., Jr., Problem 5,561.

Brass on Lead Castings

Q.—I am enclosing two sets of novelty castings made from lead alloys.

The one set, consisting of a key, a boat, a shoe and a pistol, you will note, have a somewhat golden tint. This tint is what I would like to duplicate in the articles included in the second group of novelties.

Will you inform me whether this tint is acquired by plating, dipping or burnishing? If either of these processes are used, details concerning the exact method of application will be very helpful.

A.—The sample novelty castings submitted have been given a deposit of brass in order to produce color. They have been plated in a barrel which has had a burnishing effect. A brass solution of the following composition can be used:

Copper cyanide	3.6 ozs.
Zinc cyanide	1.2 ozs.
Sodium cyanide	7.5 ozs.
Sodium carbonate	4.0 ozs.
Water	1 gal.

Temperature 75-100° F., anodes 80% copper, 20% zinc, free cyanide 2.5 oz./gal.

One point of ammonia added to each 100 gals. will aid in producing a good color when starting a new solution.

Arsenic is used as a brightener. Dissolve 2 lbs. of caustic soda in $\frac{1}{2}$ gal. water, and then add 1 lb. of white arsenic. Use 1 oz. of this solution to each 100 gals. plating solution. An excess must be avoided as it will cause the anodes to turn black.

—T. H. C., Problem 5,562.

Colored Lacquers

Q.—As a subscriber of your paper, please give me your advise as to how I can secure the finish of the two samples attached.

Please give me the formula and how to apply it.

The samples are pieces of iron hoops. I intend this finish for door bolts made of sheet iron.

A.—Both samples submitted have been finished with a lacquer to which has been added a dye to produce the desired color. Such lacquers may be purchased in the required color and either sprayed or dipped on strip.

—T. H. C., Problem 5,563.

Imitation Gold

Q.—What is a good solution for cheap gold dip or gold dye?

A.—A cheap gold like finish can be obtained by giving the work a good color brass deposit and then applying a gold dye lacquer.

To gold dye lacquer the work is first lacquered with a clear lacquer and allowed to dry. Then it is dipped in the dye solution which imports the gold color.

The work is then rinsed and dried.

A special lacquer and dye must be used for this work. This can be obtained from any of the well known lacquer houses.

—G. B. H., Jr., Problem 5,564.

Lead Contamination in Nickel Solution

Q.—What is a good method of removing lead contamination from a nickel solution?

A.—The amount of lead that can remain in a nickel solution is not large as excess amounts would be precipitated as lead sulphate.

With this in mind it can be seen that no ordinary chemical method of precipitation would give much relief. About the best thing to do is to remove the mud from the bottom of the tank (which may contain a considerable amount of insoluble lead salts if lead accidentally got into the solution) and then working the solution with dummy cathodes as long as necessary.

If possible the solution should be filtered before electrolyzing. In any case, it is important to have the mud removed as the lead contained in it will only continue to contaminate the solution as fast as the solution is freed of the metal by the current.

After electrolyzing, clean off the anodes as some lead may go to the anode.

—G. B. H., Jr., Problem 5,565.

Tank Linings for Chromium

Q.—In an earlier inquiry we asked you about chromium tanks. We have used a steel-tank, lined with antimonial lead (7%), with glass-plates also in bottom and sides, to eliminate stray currents. It did not prove a success. The lead was badly dissolved in the neighborhood of the anodes in spite of the glass. Where the glass was cracked the lead was also destroyed. Our trouble is that we do not want iron in our chrome-solution and look for a way to keep it out. Please give your advice.

A.—In regards to the trouble you are having with break-down of the lead lining in your chromium tank, it is caused by stray currents. It would seem from the description of conditions that a direct short circuit is present.

It is absolutely necessary to insulate tank from exhaust system, steam and water coils, and from plating room floor. Sufficient insulation should also be provided on both anode and cathode rods. If proper insulation is provided

on the tank and glass lining used, little or no pitting of the lead lining should result.

If proper and sufficient insulation has been provided and break-down of the lead lining still continues, the only suggestion is the use of an acid-resisting brick lining. Such linings have been very successful for chromium plating solutions.

Such linings are available in this country, from any reliable plating supply company.

—T. H. C., Problem 5,566.

Tumbling Medium

Q.—Please let us know what is the best material for use in a tumbling barrel for tumbling aluminum or brass castings.

We have tried using sandstone and water, but this is too messy; but we have also tried sand and wet sawdust, but this leaves too much of this material sticking to the castings.

Whatever material you do suggest, please let us know approximately how long the castings should be tumbled.

A.—If aluminum or brass castings mentioned are rough and it is necessary to remove metal to bring up a smooth finish, abrasive rolling is required. Abrasive rolling is naturally somewhat messy but it is essential in order to cut down rough surfaces.

For rolling aluminum castings, use fine grade of sea sand (about 2 pecks for medium size load and enough water to cover work). Add about 2 oz. of soda ash to water so that it is slightly alkaline. Roll for about 5 to 10 minutes, allow abrasive to settle and drain off dirty water; add more water and alkali and repeat rolling operation. This is done until solution is fairly clear. After solution has cleared, roll until desired finish is obtained. Time is entirely dependent upon roughness of castings. Speed of barrel from 15 to 30 RPM.

After rolling, rinse well in cold running water to remove abrasive. A high lustre may be obtained by ball burnishing after sand rolling, or may be used to finish castings directly if they are not rough as burnishing has no cutting action but has a peening effect in that it applies pressure to projecting points or particles and flattens or spreads them out.

Casting can be ball burnished in a hardwood lined barrel using about 5/32" diam. hardened polished steel ball. Approximate ratio of balls to work should be about 2 to 1 by volume.

Work which has been previously cleaned is placed in barrel about 2/3 filled with water and about 2 to 4 oz. neutral soap flakes added. Rotate barrel at about 25 to 35 R.P.M. for about 1/2 hr. and remove dirty solutions; rinse barrel and add clean water and soap; roll until desired finish is obtained; time is dependent upon size of castings, finish desired and size of load.

The same procedure outlined for aluminum castings both sand rolling and ball burnishing can be used for the brass

castings with the following exception: add 2 oz. caustic soda to water in sand rolling instead of soda ash.

—T. H. C., Problem 5,567.

Yellow Nickel Plate

Q.—Under separate cover I am sending you a sample of nickel solution for analysis, also two cap pistols as samples of work plated in this solution. I wish to find out if possible, what is the cause of this nickel turning yellow in a week or so after being plated. The pistol with tag No. 1 was plated on Jan. 6, 1937. The other pistol (tag No. 2) was plated on Jan. 21, 1937. Both pistols were plated in the same solution, same length of time (45 minutes) with 100 amperes of current passing through 230 gallons of solution with 112 of these pistols as the cathode.

Solution Formula

Double nickel salts	8 ozs.
Single nickel salts	4 ozs.
Boracic acid	2 ozs.
Sodium chloride	2 ozs.
Nickel chloride	2 ozs.

After plating and buffing, pistols are cleaned in an electric cleaner.

A.—Upon examination of the samples submitted it is seen that the trouble is due to insufficient deposit of nickel. The yellowish color is due to the fact that the iron is not completely covered and is staining through the porosity of the nickel.

Analysis of the nickel solution shows:

Nickel	5.35 ozs./gal.
Chloride, as ammonium chloride95 oz./gal.
pH	5.7

The nickel is too high and the chloride is too low. A good nickel concentration is 3 ozs./gal. and the ammonium chloride should be 3 ozs./gal. With the chloride too low you are not getting proper anode corrosion and it will take a higher voltage to get the correct current through the solution.

It would not be advisable in your case to increase the chloride by adding ammonium chloride, as you have too much ammonium ion in the solution, having used double salts in making the original solution. The high ammonium ion content will cause salts to crystallize out when the solution gets cold. A faster plating and more soluble solution can be made from the formula as given on page 18 of the 1936 edition of the Platers' Guidebook, published by Metal Industry.

Probably the best thing to do until correcting the solution is to plate more nickel on the work. This can be done by increasing the current density. The solution temp. should be at least 75 deg. F. with your high metal content. Also, the cast iron will take a nickel deposit better if it is given a good coat of copper from a cyanide solution. This will cover up irregularities in the metal better than the nickel will.

—G. B. H., Jr., Problem 5,568.

Practical Brass Foundry Digest

By H. M. ST. JOHN

Chief Metallurgist, Detroit Lubricator Company; Associate Editor, METAL INDUSTRY.

Short Abstracts of Articles of Interest to Practical Non-Ferrous Foundrymen and Metallurgists.

Founding of Aluminum Bronze. J. E. Crown. *Metal Ind.* (London), Vol. 49, p. 153 (Aug. 14th, 1936). A paper presented before the American Foundrymen's Association.

See previous abstracts.

Manganese Bronze. F. R. Hensel. *Metal Ind.* (London), Vol. 49, p. 158 (Aug. 14th, 1936). A paper presented before the American Foundrymen's Association.

See previous abstracts.

The Corrosion of Metals. T. P. Hoar. *Metal Ind.* (London), Vol. 49, p. 177 (Aug. 21st, 1936).

A critical review of research results published during the past eight years.

High Tensile Strength Brasses. H. J. Miller. *Metal Ind.* (London), Vol. 49, p. 201 (Aug. 28th, 1936).

A review of the properties and uses of the alloys commonly termed manganese bronzes. These are compared with the straight copper-zinc alloys and with the brasses which contain tin as the only added element.

Notes on Etching and Microscopical Identification of the Phases Present in the Copper-Zinc System. J. L. Rodda. *Metals Technology*, Vol. 3 (Sept., 1936). Preprint of a paper presented at the Oct., 1936, meeting of the A.I.M.E.

The alpha and beta phases of copper-zinc alloys may readily be identified by color. By a method of electrolytic etching described in the paper, the gamma, epsilon and eta phases may also be identified.

The Solid Solubilities of the Elements of the Periodic Subgroup Vb in Copper. J. C. Mertz and C. H. Mathewson. *Metals Technology*, Vol. 3 (Sept., 1936). Preprint of a paper presented at the Oct., 1936, meeting of the A.I.M.E.

Describes an experimental determination of the solubility in copper of phosphorus, arsenic and antimony. Bismuth is practically insoluble in solid copper.

Beryllium and Its Alloys. Part III. Jack Delmonte. *Metals & Alloys*, Vol. 7, page 239 (Sept., 1936). A correlated abstract.

Beryllium is replacing phosphorus in cast copper which has first been deoxidized by boron carbon, calcium, lithium or magnesium. Improved physical properties are obtained along with

a comparatively high conductivity. The castings may be age hardened by heat treatment. Beryllium nickel alloys show great promise. Other alloys are discussed.

Eliminate Defects by Avoiding Common Pitfalls. N. K. B. Patch. *Foundry*, Vol. 64 (Sept., 1936), page 25.

A review of errors in brass foundry practice which are frequently responsible for much scrap. Yellow brass, red brass, phosphor bronze and aluminum bronze are included in the discussion.

Certain Small Factors Found in the Melting of Bronze. C. Dennerly. *Bulletin of l'Association Technique de Fonderie*, page 78 (March, 1936).

Oxidizing substances such as manganese dioxide remove hydrogen and certain metallic impurities. Sulphur may be partially eliminated by the use of manganese, soda ash or nickel. Many substances are used as deoxidizers, among which phosphorus and charcoal are as good as any. Aluminum, silicon and alpac, if used, must be handled with great care. Among gases which may cause porosity, hydrogen, oxygen, carbon monoxide and carbon dioxide are mentioned. It is suggested that bronze should be melted in a reducing atmosphere, then exposed to slight oxidation before pouring.

Spectrograph for Rapid Industrial Application. M. F. Hasler and R. W. Lindhurst. *Metal Progress*, Vol. 30 (Sept., 1936), page 59.

An explanation of the methods used for rapid and accurate qualitative and quantitative analysis by means of the spectrograph. A complete analysis of 15 or 20 elements, including impurities present in very small amounts, can be made in about 30 minutes.

Coloring of Metals: Part 4: Zinc and Die Castings. Herbert R. Simonds and C. B. Young. *Iron Age*, Vol. 138 (Sept. 3d, 1936), page 30.

Interesting methods for coloring zinc have been developed in the laboratory but have had little commercial use as yet. Brown, black, blue and purple colors can be produced. In the Schulein process a black finish is produced electrochemically by the use of alternating current in a chromic acid solution. An ebony black can be produced by dipping the parts in suitable chemical solutions. (Formulas given.) Other solutions result in colors varying from steel blue

to deep purple. The Cronak process, using an acid solution of sodium dichromate, is commercially successful as a means for protecting zinc against corrosion by water or moist air; the color of the protective film varies from a light greenish yellow to a deep yellow brown. Zinc is also a prominent constituent in alloys of various colors, such as manganese bronze and the nickel silvers (to say nothing of brass).

High Tensile Strength Brasses. Part II. H. J. Miller. *Metal Ind.* (London), Vol. 49, page 229 (Sept. 4th, 1936).

Among the quaternary alloys the most important are those which contain copper, zinc and aluminum as the three essential elements. The influence of manganese is small but definitely beneficial; like iron, it refines the grain and tends to prevent excessive crystal growth during slow cooling of large castings. Tin seems to impair ductility and is not desirable in conjunction with aluminum. However, in castings intended for corrosion resistance, about one per cent of tin is desirable, with aluminum restricted to less than 0.5 per cent. Nickel improves the properties of the higher aluminum alloys (around 3 to 4 per cent of each). Applications of manganese bronze alloys are discussed with special reference to their corrosion resistance and fatigue strength.

Manufacture, Testing and Use of Alloys. R. de Fleury and H. Portier. *Metal Ind.* (London), Vol. 49, page 285 (Sept. 18th, 1936). A paper presented at the Paris meeting of the Institute of Metals (British).

In the foundry, indirect factors, unrecognized, often produce unexpected and unfavorable results when new alloys or new methods are introduced. These must be determined and corrected before the new thing can either be accepted or condemned.

Mechanical Properties of Aluminum and Its Alloys After Prolonged Heating. A. von Zeerleder and R. Irmann. *Metal Ind.* (London), Vol. 49, page 289. A paper presented at the Paris meeting of the Institute of Metals.

An account of experimental work dealing primarily with wrought metals.

The Boundaries of Metal Crystals. Part I. E. H. Bucknall. *Metal Ind.* (London), Vol. 49, page 311 (Sept. 25th, 1936).

A theoretical discussion.

Modern Equipment

**New and Useful Devices,
Metals, Machinery
and Supplies.**

Giant Aircraft Forming Press

The huge hydraulic metal forming press illustrated in Figure 1 is indicative of the tendency toward the use of ever larger and more powerful machines to meet the expanding production requirements of the aviation industry for the construction of large all-metal planes. This press is one of the largest so far

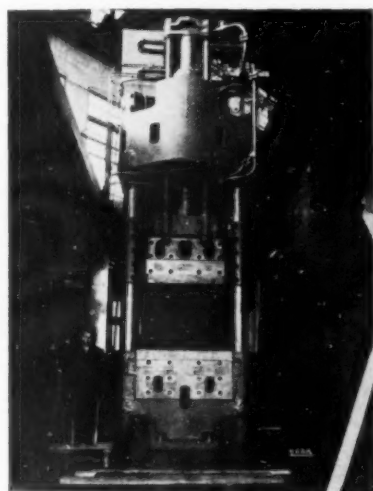


Fig. 1. Farrel Hydraulic Metal Forming Press

built employing the modern, self-contained, oil power unit and is the largest press of this type in use in the aviation industry.

The press stands nearly 26 feet high, weighs 175 tons and took five railroad cars to transport it from the plant of the Farrel-Birmingham Company, Inc., at Ansonia, Conn., where it was built, to the plant of the Lockheed Aircraft Corporation, at Burbank, Calif., where it was installed for blanking and forming duralumin aircraft parts. In spite of its tremendous size, weight and power, the press occupies only 120 square feet of floor space.

The press will exert a maximum pressure of 2,000 tons under a hydraulic pressure of 2,300 pounds per square inch on one 38-inch ram and two 20-inch rams. While the maximum capacity of the press is 2,000 tons, the pump control is of such design that a wide range of hydraulic pressures may be obtained by a simple adjustment of pump controls, thereby varying the capacity of

the press, as expressed in tonnage, in direct proportion to the hydraulic pressure. Provision is also made for using the central 38-inch ram only, giving a capacity of 1,300 tons. Two 10-inch diameter, single acting push-back rams raise the moving platen to open position.

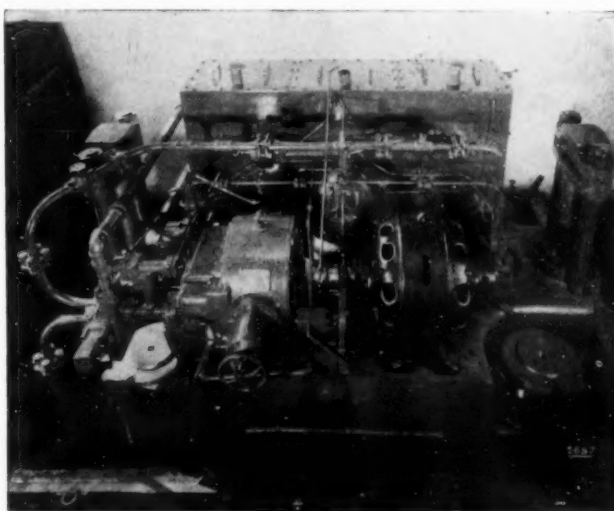
The dimensions of the clear space available between tie rods are 61 inches wide by 97 inches long. The overall dimensions of the bottom crosshead and of the moving platen are 96 inches by 133½ inches. Both the moving platen and the bottom crosshead are provided with T-slots running the width of the press and with machined surfaces for future addition of platen extensions.

The press is designed with a maximum opening of 60 inches and a maximum stroke of 36 inches. Closing speed is 130 inches per minute, with a pressing speed of from one to ten inches per minute. The traverse, or return speed is approximately 130 inches per minute.

Figure 2 shows how the power generating equipment, consisting of a motor driven pump, valves, piping and oil storage tank, is mounted on top of the press. The hydraulic pressure pump is the radial piston type, with variable pressure control and is driven by a 100 H.P., 585 R.P.M. squirrel cage motor.

The entire control of the press is effected from a control station located near a corner of the press and consists

Fig. 2.
View of the
Top
of the
Press



Latest Products

Each month the new products or services announced by companies in the metal and finishing equipment, supply and allied lines will be given brief mention here. More extended notices may appear later on any or all of these. In the meantime, complete data can be obtained from the companies mentioned.

Recording Potentiometer of the Round-Chart Type; called pyromaster. The Bristol Company, Waterbury, Conn.

All-Purpose Electric Fan; can be clamped to a rest; can be hung on the wall; can be stood on its own base. Samson-United Corporation, Rochester, New York.

Slow Speed Drills; for steels with high nickel content. Skilaw, Inc., Chicago, Ill.

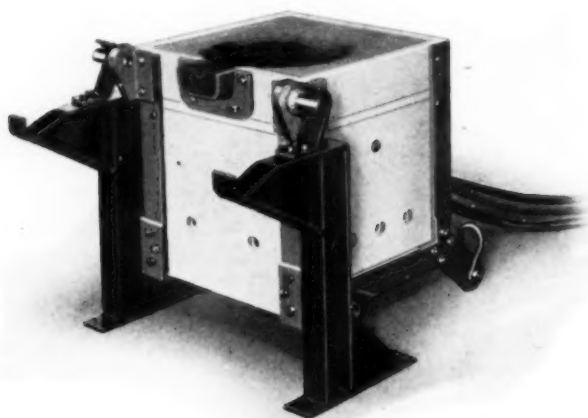
Shear for Cutting Flat Steel Bands. Acme Steel Co., Chicago, Ill.

of a hand lever to control the movements of the hydraulically controlled operating valve, a push button for starting or stopping the motor and two gauges to indicate the pressure on the rams.

Small Tilting Electric Furnace

A 60-pound tilting induction furnace has been built by the Ajax Electrothermic Corp., Trenton, N. J. This furnace is largely for laboratory use

Better heat insulation is claimed because of the built-in crucible eliminating the need for air space or a hard layer of refractory just outside the



Induction Furnace for Non-Ferrous and Precious Metals

but it is flexible enough for use in a variety of installations.

It is restricted to non-ferrous metals and precious metals. Wherever more than 30 lb. of brass or copper are to be melted, the tilting arrangement is found advantageous. The furnace is also suitable for the commercial melting of silver and gold.

crucible. Time required to make crucible changes is approximately one-half hour. The furnace melts 60 lb. of brass in 70 minutes from a cold start and melts the same quantity in about 40 minutes from a hot start.

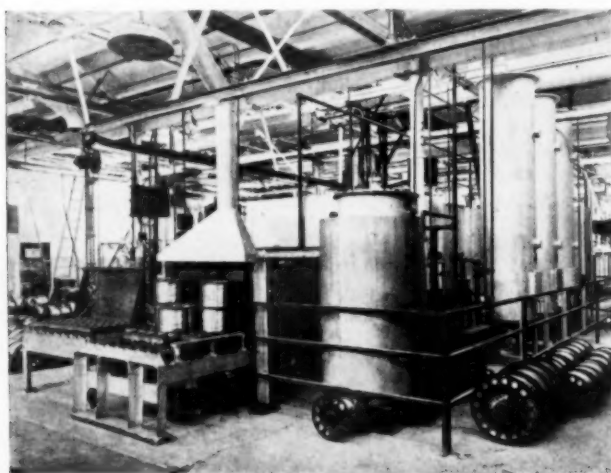
The circuit in the convertor equipment is oscillatory with a frequency of about 25,000 cycles.

Continuous Special Atmosphere Furnace

The Electric Furnace Co., Salem, Ohio, has developed and recently installed in a prominent wire plant, a new continuous special atmosphere furnace for bright annealing copper wire.

This furnace is of the straight through, pusher type for annealing continuously. It handles coiled wire as well as fine wire on spool, and heavy gauge wire on large reels. It is rated at 100 K.W. and is designed to operate

at temperatures ranging from 700 to 1000° F. As shown in the illustration the material to be annealed is loaded on trays and at predetermined intervals, automatically pushed through the charging vestibule into and through the heating chamber, through a cooling chamber and out the other end through a discharge vestibule, out onto an unloading platform. From this platform the tray of material is unloaded and the emptied



Charging
End of
Bright
Annealing
Furnace

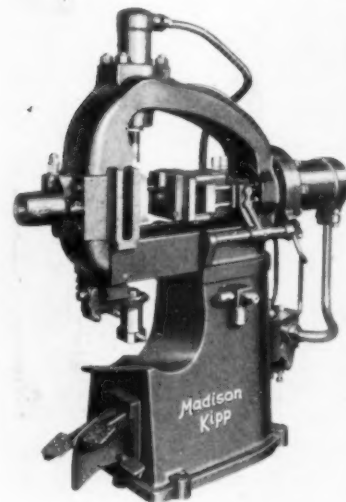
trays returned to the charging end. A special protective atmosphere is used throughout the furnace which is produced in an "Elfurno" gas generator, is located along the right side of the furnace.

The furnace uses no water seals or vapor of any kind, keeping the wire dry at all time and it is claimed, eliminating staining and the necessity of drying. It is claimed that the wire is discharged from the furnace, uniformly annealed, absolutely bright and dry, ready for shipping, further processing or fabricating.

The furnace shown in the illustration is about 85' long and has a capacity for bright annealing of 36,000 lb. of wire per day. It can, of course, be built in varied sizes to fit special requirements.

Brass Die Casting Machines

The Madison-Kipp Corporation of Madison, Wisconsin, has announced new equipment for casting brass and rigid analysis aluminum by the high-pressure method of casting metals in



Brass Die Casting Machine

the plastic state. The new list of products includes three machines, five sizes of hydraulic pumping units and a new design for electric holding furnaces.

The experience of Josef Polak of Prague, Czechoslovakia, Europe's leading exponent of high-pressure brass die casting, has been available to the Madison-Kipp organization for some time. Arrangements were made with Transforma Actien Gesellschaft, who own many of Polak's latest patents, for exclusive manufacturing license in the United States, Canada and several other countries.

The machine here illustrated is Model 256. It is fully hydraulic in operation, as is the case with all models and sizes in the new series of machines.

One of the unusual and novel features of the plastic metal type of casting machine is that the casting metal

well is provided in each die. This well is made to the proper size for the forcing plunger of the machine having only a small amount of clearance for ease of operation. This clearance is varied somewhat with the type of metal to be cast. Provision is made in the machine so that ejection of the casting can be made on either the movable or the stationary half of the die. This permits considerably more latitude than is usual in designing complicated dies and dies requiring special coring.

Madison-Kipp Hydraulic Power Unit No. P-2 is supplied with the 256. Line pressures are up to 2,500 pounds, which provide a die holding pressure of 30,000 pounds and 7,700 pounds per square inch for the standard diameter metal forcing plunger. Arrangements for higher plunger pressures are available where necessary, and the speed of travel of the forcing plunger may be regulated to suit the casting conditions of various metals and for particular requirements of special dies. In the larger machines the metal forcing

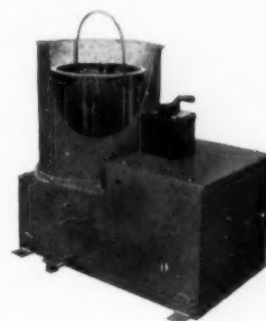
pressures may exceed 20,000 pounds per square inch.

The metal for casting is held in a plastic stage in the newly-designed holding furnace. Almost any metals which have a plastic range can be cast, but the most practical alloys are Madison-Kipp Yellow Brass Pressure Die Casting Alloy No. 1 and Madison-Kipp Manganese Bronze Pressure Die Casting Alloy No. 2, Aluminum and Magnesium alloys, to which list could easily be added the lower temperature metals, which in certain cases must be cast under the extremely high pressures provided by these machines.

The 256 machine, as well as the 1220 or 900 machines, may be equipped with hydraulic core pulling mechanism to actuate cores from either side of the machine or at the bottom of the die. As is the case with Madison-Kipp automatic and semi-automatic machines, mechanical core pulling devices and automatic ejector mechanism may be applied to this brass type of die casting machine.

drum switch is used for operating the motor in either direction.

A quick operated foot brake enables the operator to slow the machine down almost instantly and allows for quick reversing of the general direction of the



Kreider Centrifugal Dryer

basket. The machine is driven by V-belts and equipped with a special belt tightener. The cylindrical frame which holds the basket is of heavy construction. The basket is revolved at 675 R.P.M. Floor space required, 32" x 18".

A machine, capable of being driven by belt from a line shaft is also available.

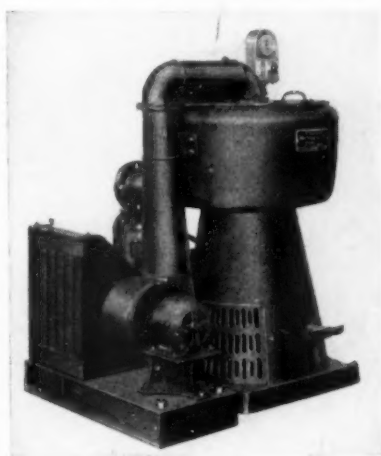
Centrifugal Metal Dryer

The Tolhurst Division of American Machine and Metals, Inc., has just placed on the market an improved centrifugal metal dryer. This type of machine is employed throughout the metal industry to dry small metal parts. Its use, it is said, entirely eliminates sawdust tumbling and its attendant difficulties. The pieces to be dried are placed into a removable perforated basket. This basket is placed in the centrifugal and rotated at high speed while blasts of hot air are forced through and around the parts. The centrifugal force developed throws off the moisture, while the hot air completes the drying in an extremely short time, whereas sawdust tumbling usually requires from 20 to 25 minutes for drying. This operation can, it is claimed, be accomplished by the Tolhurst Centrifugal Metal Dryer in from 2 to 3 minutes. The rapid drying, it is stated, prevents any spotting, tarnishing or oxidation of the pieces and imparts a fine finish to the product. This is particularly important when the drying is to be followed by lacquering, as no sawdust particles adhere to the pieces. Small holes and slots in the product, too, are never clogged with damp sawdust. Since there is no tumbling, the parts cannot be mutilated or scratched.

The improvements include compact drive, through "V" belts, by a vertical motor mounted on a bracket attached to the casing. A new and efficient electric heater equipped with a powerful blower

is used in supplying the air. Timer controlled operation saves lost minutes and increases production.

The uses of the Tolhurst Centrifugal Metal Dryer range from safety razors, watch parts and cabinet hardware, to automobile parts, lock washers and hair-pins. For a detailed description of



Tolhurst Centrifugal Dryer

the machine together with the specifications and capacities of the different sizes, write for the new Metal Dryer Bulletin "Drying Small Parts at Small Cost" to the Tolhurst Division—American Machine and Metals, Inc., 100 Sixth Ave., New York City, N. Y.

Centrifugal Metal Dryer

A. M. Dellinger, Inc., 725 N. Prince St., Lancaster, Pa., are the manufacturers of the new Kreider centrifugal dryer, a motor-driven machine. The

base is built throughout of steel plate construction and electric arc welded at all points. The $\frac{3}{4}$ H.P. ball bearing motor is fully enclosed and a reversing

New Process for Manufacture of Lead Pipe and Sheet

Two new processes have been developed by the Andrews Lead Co., Inc., 30-48 Greenpoint Ave., L. I. City, N. Y. These processes were demonstrated at their plant.

The process for making lead pipe was arrived at by the development of special dies and applying the core and bridge type of extrusion apparatus to eliminate the old difficulty of having the core off dead center, which resulted in dies of unequal wall thicknesses. A much smaller die core and ram are used, requiring higher pressures, but it is claimed, producing a product free from scoring, lamination and other effects. Accuracy and wall thickness are said to be plus or minus 0.001", with no sponginess and a finely finished inside. A greater strength is also claimed because of the higher pressure and a finer grained structure.

The sheet lead manufacturing process was developed to overcome the old disadvantage of ordinary sheet lead, the fact that it has not enough strength to support itself and when installed in certain equipment, buckles or creeps. The lead, before rolling into sheets, is coated with a layer of antimonial lead. Consequently the rolled product has one face of pure lead and the other of antimonial lead.

Sheet with pure lead facing on both sides of the antimonial lead can also be produced.

Industrial Color Service

Formation of an Industrial and Transportation Color Service has just been announced by The Sherwin-Williams Company, 292 Madison Ave., New York. It is under the direction of R. H. Hookway, Sherwin-Williams Colorist. This new department combines its efforts with those of the S-W Paint Engineering Service to offer designers, manufacturers and industrial consultants assistance not only in developing desired colors and combinations for "dressing up" new or old products, but also information on types of finishes and their suitability for specific application requirements. After the color scheme is worked out, panels and paint-out tests are made on the material to be finished. These tests are made to assure the desired application qualities—durability, degree of gloss and color retention.

Mr. Hookway's department has cooperated with industrial designers and manufacturers on special problems of color and finishes on such well-known jobs as The New Haven Streamlined Comet, The New York Central Mercury, The Southern Pacific's new streamlined trains, Pennsylvania Ferryboats, Packard Motor Cars, Hoover Vacuum Cleaners, Cleveland Tractors, and a long list of automotive, trucking and transportation companies, to name a few.

The Sherwin-Williams Industrial and Transportation Color Service applies to all types of industry and transportation. It is a specialized color service established to aid industrial designers and designers of various industrial concerns in securing effective color treatments and suitable types of finishing materials.

type are furnished with swivel or rigid handles. Trays are furnished with either solid or mesh sides. Both baskets or trays can be furnished made of steel, brass, copper, aluminum, monel metal and nickel chrome in standard shapes,

Swivel
Bail
Type
Basket

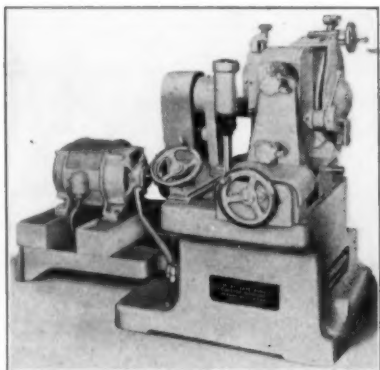


gauges of wire and mesh. Special all welded containers can be made following specifications other than standard.

Udylite also offers a Duro-Welded reinforced rigid bail type steel basket covered with hard or soft rubber highly resistant to all acids except straight nitric and sulphuric—furnished in two sizes—10 x 10" and 12 x 12" in 1/2" mesh or larger.

Tube and Rod Polishing Machine

A new production tube and rod polishing and buffing machine has been



Out-going End of Taper Feed
Machine

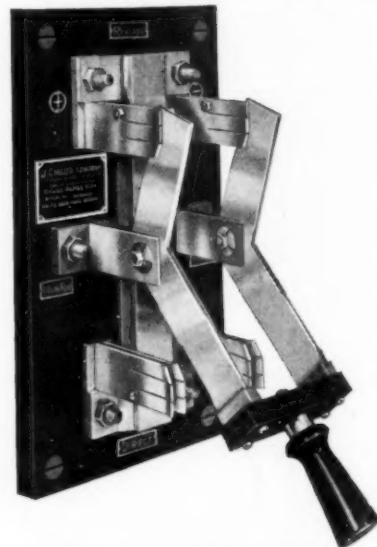
developed by the Production Machine Co., Greenfield, Mass. It is called the No. 101 patent centerless belt feed machine. It can also be furnished with a patent centerless taper, roll feed. It has a range of diameters from 1/4" to 6" inclusive.

It is stated that quick adjustment can be made from one diameter to another without loss of time; also rapid adjustment for speed of feed. The standard belt feed machine is suitable for straight tube or rod polishing; a roll feed type can be used for tapered as well as for straight polishing.

The type of wheels used is similar to those employed on a polishing jack, but mechanical means are provided for rotating and feeding the rod across the face of the wheel, thus replacing skilled labor. The machine is also equipped with a wheel truing unit mounted on the wheel head.

New Reversing Switch

A new type of reversing switch has been developed by J. C. Miller Company, 528 Lake Michigan Drive, N. W., Grand Rapids, Michigan. The feature of this switch is the "short arc action."



Miller Reversing Switch

Contact in either direct or reverse is made by moving the handle through an arc of only 60 degrees. Ample adjustments are provided for keeping the jaws and blades tight insuring positive contact. Terminals are plainly marked on the base for convenience in installing, and cross connections of heavy copper are interposed between the switch jaws.

This switch is intended to replace the old fashioned double throw double pole switch.

All Welded Dipping Baskets and Trays for Plating

The Udylite Company, 1651 East Grand Boulevard, Detroit, Michigan has just announced a complete line of dipping baskets and trays for plating use.

Unusual strength and long life and ability to carry heavy loads without bulging under rough usage are qualities attributed to all welded construction. It is stated that this consists of eliminating all possible weakness by cross member reinforcement at points of greater stress. Wire or mesh, bottom and side cross members are welded to basket or tray from making all parts one integral unit throughout.

Udylite dipping baskets in the bail



Platers' Tray. Solid Sides, Mesh Bottom

Portable pH Meter

A new type of portable pH meter has been developed by the Thwing-Albert Instrument Co., 3339 Lancaster Ave., Philadelphia, Pa. This meter is produced in two models. Model 1 is a simple potentiometric circuit with quinhydrone or antimony electrodes or both. Model 2 is a vacuum tube type with quinhydrone, antimony or glass electrodes. Model 1, it is stated, can be easily converted to Model 2 at any time. Both models are direct reading in pH and can be used by any non-technical person.

The Thwing-Albert meter is especially adapted to potentiometric titrations, such as the making up of solutions to a definite pH, etc. The operation of this instrument is said to be entirely independent of color, turbidity and suspended matter in the solutions. It is guaranteed to be accurate to 0.05 pH or 3 MV.



Thwing-Albert pH Meter

Spray Without Mist

A spray gun for pressure tank use with an ingenious nozzle that completes atomization at the nozzle, thus eliminating 25 per cent mist and thereby resulting in a great saving of paint and other finishing materials has been announced by the G. M. Manufacturing Co., 216 North Clinton Street, Chicago, and a complete description of this G. M. No. 5 gun will be supplied on request.

Most of the story is in the nozzle, which is unusual in shape and size, with air ports so spaced that there is said to be practically no expansion before the air touches the material, thus applying all the power of expansion to the complete atomization of the paint. This, it is asserted, results in savings of about 25 per cent in material costs for finishing jobs.

Otherwise, also, the spray gun is said to be exceptionally well made, with simple but finely machined parts. It is built expressly for use on pressure material containers, or paint pressure lines, requiring 20 to 30 pounds material pressure and 60 to 80 pounds air

pressure. It is recommended for spraying lacquers, enamels, oil paints, varnishes, cold water paints, calcimines, etc.; without special nozzles for each material.

The double breakage and the fine



G. M. No. 5 Spray Gun

atomization it is claimed, eliminates orange peel because it enables the operator to apply a much wetter coat of material. Secondly, reducing 25 per cent of spray mist will show a distinct saving in material.

Polishing Wheel Cement

A new cement for polishing wheels is announced by Midwest Abrasive Company, of Detroit, according to James T. Jackson, president. It is intended to replace glue and is offered as a simplified method of preparation, requiring no heat. By the use of a special thinner, it is stated, any density of cement required can be made up so that wheels of varying densities can be uniformly surfaced. This feature permits exact regulation for wheels of canvas, leather, felt, sheepskin, wood covered with leather, compressed leather or felt. The manufacturers state that many large users of polishing wheel

cements in the Detroit area are using it with marked success.

The policy of the company is to send generous sized samples of the product to those interested in its use. Readers of this journal are invited to take advantage of this offer.

Paint for Metal

Tornalac is a new paint developed by the Paper Makers Chemical Department of the Hercules Powder Co., Kalamazoo, Mich., for industries manufacturing food or beverage products. This material it

is stated is resistant to acids, alkalies, salt solutions, gases and vapors and bleaching solutions.

Tornalac can be brushed, or sprayed. It dries in from 30 to 60 minutes, covers about 300 to 350 sq. ft. per gallon. It is available in a variety of types suitable for various purposes in a wide variety of industrial applications.

Combination Rubbing-Polishing Method

An unusually fast and effective "double-action," rubbing-polishing method for lacquer and synthetic finishes on metal as well as wood surfaces is now said to be available. To manufacturers of furniture, automobiles, cabinets, fixtures, etc. this method is recommended because the "double-action"—first abrasive, then polish—accomplishes two results in one operation with no interruption in labor.

Sold under the name of Imperial Rubbing Compound, the product is a mixture of rare oils and pigments, which, it is stated, quickly and easily rubs down scratches caused by sanding, and smoothes out that "orange peel" effect which forms after spraying. Then, as the compound dries and packs on the rubbing cloth, its polishing properties are said to become active—a bit more rubbing produces the amount of lustre desired.

Imperial Rubbing Compounds are available in two grades. Grade "E" produces the higher finish; Grade "XX" is faster, not so lustrous, and is used where a cut is desired more than a polish. Both grades, however, it is claimed, give a good cut and a fine, dry, lustrous polish.

They are manufactured by Wilson Imperial Co., 115 Chestnut Street, Newark, N. J.

Flexible Finish for High-Grade Metal Products

A new flexible finish for high-grade metal products subjected to extremely hard usage, such as golf sticks and fishing rods, has been developed by Maas & Waldstein, makers of industrial finishes, Newark, New Jersey.

In gloss and wearing qualities, the new finish, which is known as "Duflex," closely resembles the finish produced by extruding or cementing celluloid upon a metal base, according to the manufacturer. The cost, however, is lower.

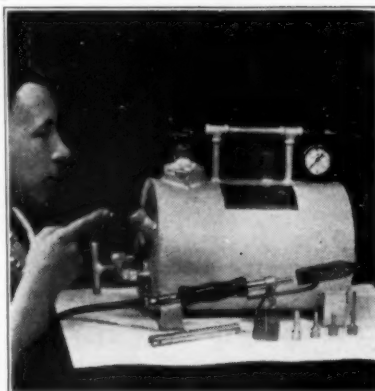
In finishing a product, such as the metal shaft for a golf club, by the Duflex process, the product is first covered with a primer coat of synpex enamel, which air-dries rapidly and does not require baking before graining. The grain is then applied in the usual manner, (if wanted) and both coats are baked. After baking the product is given five dip-coats of clear Duflex lacquer. The resulting finish, the manufacturer states, has a deep gloss and is very flexible and durable. Any metal can be finished by this process.

Soldering and Brazing Unit

Reiner & Campbell Inc., 242 Lafayette St., N. Y. are the manufacturers of a new soldering and brazing unit called the Ace. This is a portable acetylene gas generator fitted with torch and blow pipe tools. Gas is produced by the generator without pumping or preheating and carbide can be charged into it while it is in operation. The generator will run for about 4 to 5 hours at one filling of carbide and one charge of water will take care of three charges of carbide.

The unit is provided with heat regulation so that the copper tip will be held at the desired temperature. Needle valve regulation is provided for torches.

It is stated that there is no smoke, dust dirt or sparking and that the unit is windproof. Dimensions are 10" high by 13" long.



"Ace" Soldering Unit

New Electrostatic Precipitator

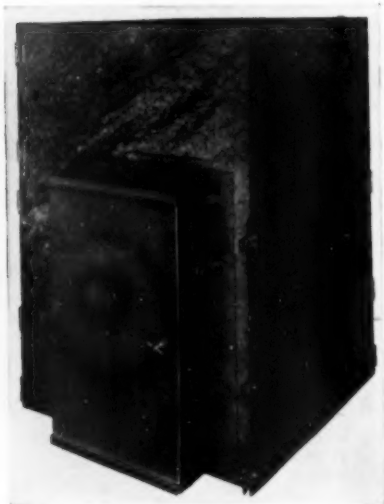
A new electrostatic precipitator for general industrial air cleaning use with an operating efficiency as high as 99% by weight is announced by the Pangborn Corporation of Hagerstown, Maryland. The unit is particularly suitable for salvaging valuable dust, mass air cleaning, or removing objectionable par-

ticles from gas or vapor and similar applications.

The Pangborn Electrostatic Precipitator with electrical parts by Westinghouse is said to have following advantages:

1. Small size of unit reduces space requirements and cost and permits a complete factory assembled unit.
2. Small vacuum tube power pack attached directly to precipitator cabinet eliminating the usual separate room for high voltage generating equipment.
3. Discharged air does not contain appreciable amounts of ozone nor oxides of nitrogen and may be breathed without irritation of the membranes.
4. May be designed for efficiencies as high as 99% (by weight) and to remove particles as small as one-fifth micron.
5. Operates at lower voltages permitting use of electronic tubes of standard industrial classification and with lower power consumption.
6. Low and constant air flow resistance through the unit resulting in reduced power and uniform air volume.

In general, the complete unit consists of three parts; collector cells, ionizing assembly, and power pack. These may be furnished assembled in a standard cabinet or as parts for assembly in existing duct work or special cabinets.



Electrostatic Dust Precipitator

Cement for Abrasives

Bond-Rite, a glaseless oiling-out cement is made by Adhesives, Inc., 525 Lafayette Ave., E., Detroit, Mich. This cement is recommended for automatics, leather, felt, cotton, canvas, paste and leather covered wheels and belts. The

manufacturers state that it is not affected by frictional heat, moisture or humidity and that it is easily applied with brush, spray gun or sponge rubber roll.

Bond-Rite is an inorganic water soluble cement. It can be thinned with

Bond-Rite 600 thinner, formulated for that purpose and applied on wheels sized with Bond-Rite 700 sizer.

It is made to withstand extreme frictional heat while in use without glazing, losing any of its tenacity or softening. It is practically odorless, will not disintegrate or become rancid. It needs no heating apparatus as it is applied cold to cold wheels or belts to set cold grain, either artificial or Turkish.

Bond-Rite cement comes in five grades, 110, 120, 130, 140 and 150.

It is distributed by R. Dykstra & Co., 8502 Mack Ave., Detroit, Mich.

Rust Preventive

Ne-Ver-Rust is a new material manufactured by the Never Rust Manufacturing Co., 1771 E. 18th St., Brooklyn, N. Y. It is recommended as a positive prevention of corrosion, for application to such parts of machinery polished surfaces or any metal parts, which cannot be galvanized or protected by copper or zinc coatings.

Ne-Ver-Rust is a thin transparent liquid, which it is stated, fills the pores, producing a non-porous film coating impervious moisture and chemical action.

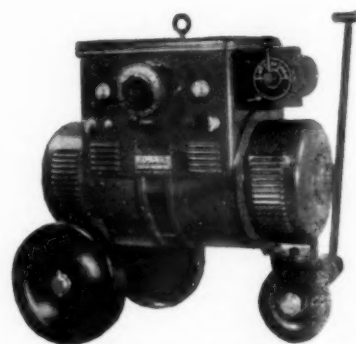
It is claimed that while Ne-Ver-Rust adheres tenaciously it can be readily removed when necessary by wiping with kerosene, benzine or other solvents.

Motor Control on Welders

A new development in arc welding was announced at the National Metal Show in Cleveland by The Hobart Brothers Co., Troy, Ohio, manufacturers of Hobart "Simplified" Arc Welders.

The New Hobart "Serial MN Current-Saving Models" embody (in addition to an improved type of wheel mounting with low center of gravity) what is termed as "Selective Motor HP Control." It is said that this is the first arc welding set equipped with economical control of the motor as well as the generator.

Only 1/3 the usual starting current



"Simplified" Arc Welder

is required—the power factor of the machine and its efficiency are materially improved—and it is possible to use the equivalent of a motor of one-half the horsepower rating for welding in ranges up to $\frac{1}{2}$ to $\frac{2}{3}$ the rated capacity of the generator.

The manufacturers' announcement claims that the results are: (1) welding current costs are cut 30% to 50% in average work; (2) power company penalties due to poor power factor of equipment are avoided; (3) expensive re-wiring of many plants is eliminated;

(4) idling and light load power losses are cut in half.

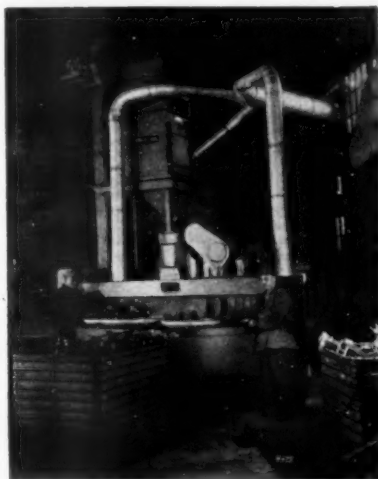
Power factor of the equipment is said to be improved in the light load ranges so that it is 90% or better in all practical welding ranges, whereas with ordinary equipment the power factor does not approach 90% until the load approaches $\frac{2}{3}$ rated capacity. This feature is specially important in these days of heavy electrical power consumption which inevitably leads to imposition of penalties on equipment with poor power factor.

New Blast Cleaning Machine

A labor saving device for foundries, metal cleaning shops, etc., is the recently announced Type "LG" Airless Rotoblast cleaning table with eight individual smaller tables which, as they approach the blasting zone, automatically start to revolve, thus presenting every exposed surface of the work placed upon them to the action of the blast.

The Pangborn Corporation of Hagerstown, Maryland, manufacturers of the Rotoblast line of airless cleaning equipment, claim that this table is unsurpassed for blast cleaning comparatively frail work, particularly of a flat character. Stove parts, shovels, tools, etc. are already being cleaned by this equipment.

With the "LG" Blast Table the Rotoblast is mounted above the rear enclosed portion of the large table in such a position that its blast stream completely covers all parts of the revolving smaller tables as they pass through its field. The spent abrasive, refuse and heavy dust drop into a pan below the table top and are conveyed into the boot of an

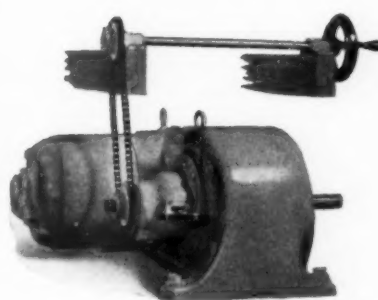


Airless Blast Table

elevator as they start back again to the separator for cleaning, then to the hopper for storage until they are again gravity fed into the Rotoblast for re-use.

Variable Speed by Remote Control

A new line of standardized parts for obtaining remote mechanical control of variable speed has been developed for use with the U. S. Varidrive Motor made by U. S. Electrical Motors, Inc., Los Angeles, Calif. The bearing supports, shafting, sprockets and chains have been standardized so that the user can obtain variation of speed on the driven machine conveniently and economically. The speed control is positive as there is no slippage in the control mechanism. Infinite speed variation within the speed range of the Varidrive may be obtained.



Remote Control of Varidrive

Protective Coating

National Oil Products Co., Harrison, N. J., are offering a new type of protective coating, called, "Nopco Heresite," a flexible, corrosion-proof material, which will adhere to various metals and withstand the severe strains encountered in everyday working conditions. Nopco Heresite coatings or baking enamels, it is claimed, offer protection against acids, mild alkalis, organic materials, oils and other metal corroding substances. They form a hard,

tough film, having a high dielectric strength.

The coatings can be applied by spraying or dipping, followed by a short period of air drying and baking for varying periods and at varying temperatures, depending upon the nature of the surface to be coated and the degree to which the coating must stand corrosion.

Complete laboratory assistance and the service of technicians are offered.

Beryllium Price Cut

The Brush Beryllium Company, 3715 Euclid Ave., Cleveland, Ohio, has announced a new low price of \$23 per pound for beryllium content, hitherto priced at \$30 per pound and above, in making public the news of its entrance into the general market for beryllium copper master alloy.

A simultaneous statement issued by Brush Beryllium emphasized that the new price resulted from development of new and distinctive processes which, it was predicted, would result in much wider application of beryllium copper. The metal, which possesses unusual qualities of fatigue, corrosion, heat resistance, and non-sparking and high impact strength, is now in use in a wide variety of services ranging from watch parts to airplane propeller hub-cones, and from crow bars to delicate surgical instruments. The ore from which it is derived has a chemical composition very close to that of emerald or aquamarine and may properly be called a crude form of aquamarine. While sources of supply were previously limited, the ore is now appearing in larger quantities at slightly decreased prices. Availability of the ore, coupled with the lower price of beryllium content and the simultaneous pickup of both the machine-tool industry and industrial construction, is seen as forecasting development of faster and more involved types of products.

New Solvent

Tributyl phosphate, $(C_4H_9)_3PO$, is now being produced in the United States for the first time by Commercial Solvents Corp., 230 Park Ave., New York. This chemical is said to possess a combination of properties which warrants its investigation for numerous applications as a solvent and a plasticizer.

It is a stable, odorless and colorless liquid with a high boiling point, a low freezing point and low solubility in water. It is recommended for nitrocellulose lacquers for the reason that it minimizes a tendency of this material to yellow or darken on exposure to light, improving their adherence and reducing their flammability.

The properties of Tributyl Phosphate CSC are as follows:

Specific Gravity: 0.973 to 0.983 at $20^\circ C./20^\circ C$.

Acidity: Not more than 0.05%, calculated as phosphoric acid.

Water: No turbidity when one volume is mixed with 19 volumes of $60^\circ Be$. gasoline at $20^\circ C$.

Color: Water-white.

Odor: None.

Refractive Index: 1.4248 at $20^\circ C$.

Molecular Weight: 266.23.

Boiling Point: $177^\circ C$. to $178^\circ C$. at 27 mm. of mercury.

Melting Point: Below $-80^\circ C$.

Flash Point: $146^\circ C$. ($294.8^\circ F$).

Solubility in Water: 0.6% by volume.

Solubility of Water in Tributyl Phosphate: 2.6% by volume.

Weight per U. S. Gallon: 8.13 pounds at $68^\circ F$.

Production Grinders

A new line of grinding machines has been developed by Sawyer Electrical Mfg. Co., 1124 E. Slauson Ave., Los Angeles, Calif.



5 H. P. Pedestal Grinder

Their high speed pedestal grinder has a very small diameter motor which drives two coarse grit Bakelite wheels

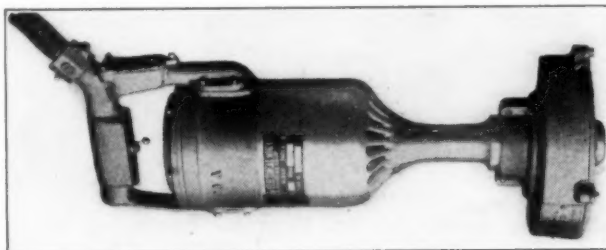
medium finish on the work. The grinder is recommended for foundry work as a time-saver.

The small diameter of the motor gives a much better working clearance than would be possible with the ordinary large motored grinder. Guard doors may be swung open to allow grinding around the wheel if necessary. This machine can be adapted for polishing, buffing and various specialized jobs.

A 1½ H.P. "Aerial Grinder" embodies a special design and it is claimed, gives it the highest "power to weight" ratio of any motor, operating on standard 220 volt, 3 phase current. The grinder has no moving electrical parts, commutator, brushes or gears. The rotor shaft drives directly through a universal coupling to the wheel shaft. The tool is equipped with factory grease sealed ball bearings and consequently does not need to be greased for the life of the bearings. Replacement bearings are standard and inexpensive.

The tool can be equipped with an 8" wheel shaft housing, 12" housing or a 3" housing. The machine can be used

1 H. P. Aerial Grinder



at 3600 R.P.M., which, it is stated, grind the work much faster than standard grinders and at the same time leave a

as a fast snagging grinder and also for wire brushing, inside tire buffing, portable polishing, etc.

Carboy Rocker

Morse Manufacturing Co. Inc., 400-408 S. Franklin St., Syracuse, N. Y., have developed a new carboy rocker for convenience, cleanliness, and safety in



Carboy Rocker

handling acids. The curve of this rocker is extended under the center of the box and shaped to afford easy tilting of full, heavy carboys for steady and safe pouring acids. It is equipped with wheels under the center of the load for convenience in moving about. The rocker is constructed of strong steel angle, each side one continuous piece, with corners double and riveted. It is made collapsible for ease in shipping.

Soldering Flux

Shur-Flux No. 400 is a non-acid soldering fluid manufactured by McNamee Products, 370 Hazel Ave., Glencoe, Ill. The manufacturers state that it will not harm the hands or clothing, has no disagreeable odor and the fumes have no effect upon the operator; that it may be left open and will not cause rust or scale upon machinery or tools in its vicinity.

As Shur-Flux is completely soluble in water, it is stated, after an application is completed and the work is washed with water, there will be no trace of corrosion or effect upon the metal itself, as the fluid attacks only the oxide.

Shur-Flux is recommended for soldering cast iron, copper, brass and all other metals except aluminum and zinc base die castings.

Galvanized Sheet Ready for Painting

Armco Galvanized Paintgrip sheets, the new galvanized metals, which, it is stated, can be painted without special preparatory treatment, were featured in a recent Armco Ironmaster Band radio broadcast sponsored by The American Rolling Mill Company, of Middletown, Ohio. The program was aired over the N.B.C. Blue network.

In the commercial announcement,



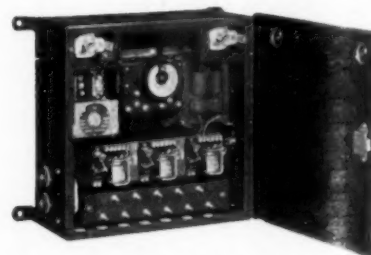
Paintgrip Gutters and Downspouts

listeners were told that contractors everywhere are ready to do all kinds of sheet metal work with these new sheets.

The illustration below shows the application of this sheet for gutters and downspouts on a residential building.

Safety Furnace Lighter

Combustrol is a safety unit manufactured by the General Combustion Corp., Engineering Bldg., Chicago, Ill., for the purpose of automatically and safely lighting the burners of gas fired oven heaters or furnaces. In addition it is



Furnace Safety Unit

said to eliminate hazards resulting from pilot flame or electrical failure. Simple accessories are provided for preventing overheating or damage due to fan, drive or motor failure as well as low gas pressure.

The unit consists of two parts: pilot thermocouple and control cabinet. A switch is provided which places the unit in operation. The operator then starts the fan, and Combustrol is in operation. An air flow relay is actuated by the flow of air. The fan operates for a predetermined period of from 5 to 10 minutes so as to exhaust from

the oven or heater any gases or explosive vapors that may have collected. At the end of this period the pilot gas valve opens and the spark plug ignites the pilot. The pilot heats the thermocouple and when the conditions are correct the main gas valve opens automatically and the burner is lighted.

After the burners are lighted, if the pilot flame fails or the source of electricity is interrupted, the gas supply to both pilot and burners is immediately shut off and the heater or furnace cannot be fired again except by the repetition of the cycle described above.

Associations and Societies

American Electro-Platers' Society

CONVENTION NEWS

Duty!

Pleasure!

Opportunity!

In these three words we of the New York Branch of the American Electro-Platers' Society sum up our attitude towards the 25th ANNUAL CONVENTION in New York City next June.

When the assembled delegates at Cleveland last June voted that the 25th ANNUAL CONVENTION be held in New York City in 1937, the members of the New York Branch were not only mindful of the great responsibility acceptance entailed, but keenly appreciative of the gracious gesture on the part of the associated branches of the American Electro-Platers' Society in conferring the SILVER ANNIVERSARY of its inception, on the place of its birth, New York City.

Our duty is, therefore, clear. We are not content in planning merely an adequate convention for next June. It is rather our earnest desire, because of the trust placed in us, to have as our goal, a convention, in its scope and breadth of conception, in line with a quarter of a century of great progress in the science of electroplating. In dignity and content, worthy of its setting, the great city of New York.

For we of New York, with all due modesty, and without any spirit of provincialism, feel justly proud of our city. The force of its resistless energy has been the magnet that has drawn to it gifted and ambitious men and women from all over the country. Every second person one meets in this city is a New Yorker by adoption rather than by the accident of birth. Therefore, New York City truly belongs to the Nation. If the following quotation, from "NEW YORK, THE WORLD'S GREATEST MARKET PLACE" appears boastful, remember that it is simply matter of fact.

"New York City is the world's

greatest metropolis, located at the mouth of the Hudson River at the southern end of New York State, and embracing five separate great cities which are designated as boroughs of the greater city. It is the center of the commercial, financial, and industrial life of the United States. What London is to England, New York is to America. It is almost impossible to speak of it truthfully without using superlatives.

Its buildings, towering so high in the air are typical of the city's development.

The people of the world gravitate to New York. The thoughtful people of the entire United States look on it as their own city, because New York belongs to the entire country and continues, as it has been since Colonial days, a vital force in maintaining and building the Nation.

It is supreme in industry. It is a leader in science. Its architecture is amazing. Its people are thrifty. It is hospitable. It is the mecca for those who seek entertainment and amusement. It is the style center of the United States and is fast coming to rank with Paris.

New York is New York and there is none like it anywhere."

The convention machinery has been set in motion. The preliminaries have been completed.

We look forward to June, 1937 with keen anticipation. To use a chemical analogy, DUTY, PLEASURE, and OPPORTUNITY is a reversible reaction:

Our DUTY to plan a great convention.

Your DUTY to help make it great.

Our PLEASURE to act as your host.

Yours the PLEASURE of a delightful four day episode.

Our OPPORTUNITY for service to the A. E. S.

Your OPPORTUNITY to spread and enhance the usefulness of the A. E. S.

THE CONVENTION COMMITTEE
LOUIS H. CATES
Publicity Chairman

Newark Branch, A.E.S.

c/o George Wagner, 1134 So. Long Ave., Hillside, N. J.

The Newark Branch of the American Electroplaters' Society will hold its 19th Annual Open Educational Session and Banquet at the Hotel Douglas, Hill St. near Broad, Newark, on Saturday, April 10. The educational session will begin at 1:30 P. M. The speakers will include:

Austin F. Fletcher, Brewer Tichener Corp., Binghamton, N. Y.

C. B. F. Young, Ph.D., Instructor, Columbia University, N. Y. C.

W. E. Bancroft, Pratt & Whitney, Inc., Hartford, Conn., on "Depositing Hard Chromium."

George B. Hogaboom Hanson Van Winkle Munning Co., Matawan, N. J., on "What Does the Ammeter Tell?"

The banquet will take place at 7 P. M. with lively music, good entertainment and appetizing food. Those who have attended Newark Branch banquets in the past know that they are always the high spots of the year.

New England Foundry Conference

A Conference on foundry and casting work will be held April 9 and 10 at the Massachusetts Institute of Technology, Cambridge, Mass. under the auspices of the New England Foundrymen's Association, American Foundrymen's Association, and the Massachusetts Institute of Technology.

Among the subjects discussed will be the following:

Non-Ferrous Casting Design.

Physical Testing and Laboratory Demonstration by Prof. J. M. Lessells. Molding Sand Control by W. G. Reichert.

Sand Testing Technique and Demonstration by E. E. Woodliff.

Los Angeles Branch, A.E.S.

c/o Earl Coffin, 710 E. 29th St.

The Los Angeles Branch of the American Electro-Platers' Society will hold a West Coast convention and exposition of plated products on March 20, 1937, at the Elks Temple, 607 S. Parkview St., Los Angeles, Calif.

The educational session will begin at 1:30 and the dinner-dance at 6:30 P.M. All platers and plant representatives are invited.

Milwaukee Branch, A.E.S.

Headquarters care of A. J. Hermansen, 539 N. 99th St., Wauwatosa, Wisc.

The Milwaukee Branch of the American Electro-Platers' Society will hold its annual smoker and meeting at the Schroeder Hotel green room April 24, 1937.

All members and others interested are cordially invited to attend the meeting and share in the well known Milwaukee hospitality. Full information can be obtained from the secretary at the address given above.

Electrochemical Society

Columbia University, New York

The Spring meeting of The Electrochemical Society will be held in Philadelphia, Pa., April 28-May 1, 1937, at the Hotel Benjamin Franklin.

An Electrodeposition Luncheon will be held on Friday, April 30 at 12 noon.

Plant visitations will be conducted on that day to the Budd Mfg. Co. and to the Leeds & Northrup Co.

American Foundrymen's Association

222 W. Adams Street, Chicago, Ill.

W. F. Bornfleth, Cutler-Hammer Inc., Milwaukee, recently appointed General Chairman of the Milwaukee Convention Committee and **Walter Gerlinger**, Walter Gerlinger, Inc., General Vice Chairman have announced the appointment of the various committees that will assist the American Foundrymen's Association in staging the Forty-First Annual Convention and Foundry Show in Milwaukee, May 3 to 7, 1937.

The various committees are enthusiastic over the prospects of the Milwaukee Convention and are predicting one of the largest the Association has ever held. The chairmen of the various committees are as follows:

General Chairman: Wm. F. Bornfleth, Cutler-Hammer, Inc., Foundry Division.

General Vice-Chairman: Walter Gerlinger, President, Walter Gerlinger, Inc.

Reception Committee: R. S. MacPherran, Chief Chemist, Allis-Chalmers Mfg. Co., Chairman.

Plant Visitation Committee: John T. Brown, Vice-President, Chain Belt Co., Chairman.

Ladies Entertainment Committee: Wm. J. Grede, President, The Liberty Foundry Co., General Chairman; Mrs. Wm. F. Bornfleth, Chairman.

Hotel Committee: Wm. J. MacNeill, Gen'l Mgr., Federal Malleable Co., Chairman.

Transportation Committee: Roy N. Jacobs, President, Standard Brass Works, Chairman.

Publicity Committee: Chas. A. Gutenkunst, Jr., President, Milwaukee Malleable & Gray Iron Works, Chairman.

Golf Committee: E. L. Roth, Gen'l Manager, Motor Castings Co., Chairman.

Stag Dinner Committee: A. G. Ziebell, President, Universal Foundry Co., Oshkosh, Chairman.

Annual Banquet Committee: L. S. Perego, President, Sivyer Steel Casting Co., Chairman.

American Foundrymen's Association Nominates Officers and Directors

The Nominating Committee of the American Foundrymen's Association met in Cleveland, Feb. 1, to prepare and present a slate of Officers and Directors subject to election at the Convention and Exhibition to be held in Milwaukee, May 3-7.

The following were nominated for Officers and Directors:

For **President**—**Hyman Bornstein**, Chief Chemist and Metallurgist, Deere & Co., Moline, Ill.

For **Vice-President**—**Marshall Post**, Vice-Pres. and Works Mgr., Birdsboro Foundry & Machine Co., Birdsboro, Pa.

For Directors to serve three terms each:

Duncan P. Forbes, President, Gunit Foundries Corp., Rockford, Ill.

H. B. Hanley, Foundry Supt., American Laundry Machinery Co., Rochester, N. Y.

C. J. P. Hoehn, President, Enterprise Foundry Co., San Francisco, Calif.

Thomas Kaveny, President, Herman Pneumatic Machine Co., Pittsburgh, Pa.

C. E. Sims, Supervising Metallurgist, Battelle Memorial Institute, Columbus, Ohio.

James L. Wick, Jr., President, Falcon Bronze Co., Youngstown, Ohio.

Connecticut Non-Ferrous Foundrymen's Association

c/o Louis G. Tarantino, 565 West Taft Avenue, Bridgeport, Conn.

The meeting held Tuesday, Jan. 19, 1937 at the Hotel Duncan in New Haven was addressed by **S. W. Chapell** of the Electric Boat Co., Groton, Conn. who spoke on "G" Metal and "Manganese Bronze" and by **Ernest Stone** of Consolidated Ashcroft Hancock Co., Bridgeport, Conn. who spoke on "Nickel Alloys."

The Entertainment Committee for 1937 was appointed:

Chairman, **Ray Hunter**, 141 Milk St., Boston, Mass.

Geo. Hubbell Mullite Refractories Co., Shelton, Conn.

Geo. King, Malleable Iron Fittings Co., Branford, Conn.

Byron Reid, Reading Pratt & Cady Co., Hartford.

L. H. Tarantino, Bridgeport, Conn.

The Program Committee for 1937 was appointed as:

Chairman, **F. B. Diana**, Whipple & Choate Co., Bridgeport, Conn.

L. A. Ward, Chase Brass & Copper Co., Waterbury, Conn.

L. G. Tarantino, Bridgeport.

President, **T. Joseph Judge**, presided. The meeting held Tuesday, Feb. 16, 1937 at same place was addressed by **V. P. Weaver** of American Brass Co., Waterbury who spoke on "Sand Cast Silicon Alloys," which was very interesting.

The meeting, to be held March 16, 1937 at Hotel Duncan in New Haven, with dinner at 6:30 P. M., will have as speaker, **Dr. A. S. Gray**, head of the Bureau of Occupational Diseases of the State of Connecticut.

Foundry Equipment Association

Penton Bldg., Cleveland, Ohio

At the annual meeting of the Foundry Equipment Manufacturers' Association, concluded yesterday in the Terminal

Club, Terminal Tower Building, Cleveland, Ohio, new officers for the ensuing year were chosen as follows:

President, **Robert S. Hammond** of the Whiting Corporation, Harvey, Illinois.

Vice President, **H. S. Hersey** of C. O. Bartlett & Snow Company, Cleveland.

Arthur J. Tuscany of the Cleveland trade association management firm of Tuscany, Turner & Associates, Penton Building, was re-elected Secretary-Treasurer of the organization. In addition, three directors to replace those whose terms expire were elected. The new directors are **Robert S. Hammond**, **H. S. Hersey** (company affiliations given above), and **O. A. Pfaff** of American Foundry Equipment Company, Mishawaka, Indiana.

In addition to the customary committee reports, special attention was given to customer relations for the purpose of defining ways and means through which the equipment manufacturers could render maximum service to the foundry industry. Of prime interest in this field is the convention and exhibit of American Foundrymen's Association to be held in Milwaukee in May.

Jewelers Board of Trade

Turks Head Bldg., Providence, R. I.

At a meeting of the Board of Directors of The Jewelers Board of Trade on February 19, 1937, the election of officers and a member of the Executive Committee was held:

President—**Frederick A. Ballou, Jr.** of B. A. Ballou & Co., Inc., Providence, R. I.

First Vice President—**Russell G. Scott** of Reed & Barton Corp., Taunton, Massachusetts.

Second Vice President—**Edgar E. Baker** of W. R. Cobb Company, Providence, R. I.

Secretary and Treasurer—**Horace M. Peck**.

Assistant Secretary and Assistant Treasurer—**Robert C. Knox**.

Howard L. Carpenter of The Albert Walker Company of Providence, R. I. was elected as a member of the Executive Committee to succeed **Edgar M. Doeherty** of the William C. Greene Company of Providence, R. I., who has retired.

Complete Executive Committee is now constituted of:

Frederick A. Ballou, Jr. of B. A. Ballou & Co., Inc., Providence, R. I.

Royal J. Greeg of Ostby & Barton Company, Providence, R. I.

Howard L. Carpenter of The Albert Walker Company, Providence, R. I.

Porcelain Enamel Institute

612 North Michigan Avenue, Chicago, Illinois

That members of the Institute of Vitreous Enamelers of England will be special guests of the Porcelain Enamel Institute at its seventh annual meeting

in October was announced following the Porcelain Enamel Institute executive committee meeting in Cleveland, January 25.

Chicago was selected as the place for the annual meeting this year. Tentative dates of October 12-13 were set. The hotel will be selected later.

Other important Institute projects discussed and approved by the executive committee were:

Renewal of research fellowship at Ohio State University, "Porcelain Enamel Week";

Architectural research;

The creation of an associate membership;

The research and market development activities of the Educational Bureau;

The "Porcelain Enamel Institute Forum."

British Institute of Metals

36 Victoria Street, London, S. W. 1, England

The Twenty-Ninth Annual General Meeting will be held in the Hall of the Institution of Mechanical Engineers, Storey's Gate, Westminster, S. W. 1, England, on March 10 and 11. The following is a list of papers for the Meeting:

Gayler, Marie, L. V. "The Theory of Age-Hardening."

Rollason, E. C. "Modern Metal Spraying: Processes and Some Characteristics of the Deposits."

Gayler, Marie L. V. "The Effect of the Addition of Small Percentages of Iron and Silicon to a High Purity 4 per cent Copper-Aluminium Alloy."

Northcott, L. "The Effect of Cast Structure on the Rolling Properties of Zinc."

Hutton, Professor R. S., and Richard Seligman. "An Aluminium Statue of 1893: Gilbert's Eros."

Cook, M. "Directional Properties in Rolled Brass Strip."

Gough, H. J., and D. G. Sopwith. "The Resistance of Some Special Bronzes to Fatigue and Corrosion-Fatigue."

McKeown, J., and O. F. Hudson. "Stress-Strain Characteristics of Copper, Silver and Gold."

McKeown, J. "Creep of Lead and Lead Alloys. Part I.—Creep of Virgin Lead."

Jones, Brinley. "A Study in the Metallography and Mechanical Properties of Lead."

Hume-Rothery, W., and Peter W. Reynolds. "The Control of Composition in the Application of the Debye-Scherrer Method of X-ray Crystal Analysis to the Study of Alloys."

Payne, R. J. M., and J. L. Haughton. "Alloys of Magnesium. Part IV.—The Constitution of the Magnesium-rich Alloys of Magnesium and Silver."

Hume-Rothery, W., and Ewart Butchers. "The Solubility of Silver and Gold in Solid Magnesium."

Haughton, J. L., and T. H. Schofield. "Alloys of Magnesium. Part V.—The Constitution of the Magnesium-rich Alloys of Magnesium and Cerium."

The following papers may be presented if time permit:—

Stephen, R. A., and R. J. Barnes. "The Estimation of Grain-Size in the Region above 10^{-3} cm."

Reynolds, Peter W., and W. Hume-Rothery. "The Constitution of Silver-rich Antimony-Silver Alloys."

Personals

Gustave Klinkenstein

Gustave Klinkenstein, recently re-elected managing executive of Maas & Waldstein Company, lacquer and enamel manufacturers of Newark, New Jersey, is an outstanding figure in the finishing industry. He has devoted his entire professional life to the formulation and



GUSTAVE KLINKENSTEIN

application of industrial finishes and is among those who are primarily responsible for the great variety of finishes now available to manufacturers of products of every description.

To Mr. Klinkenstein, lacquers and enamels are essential factors in the production and marketing of products. They must not only protect and beautify, but they must, through eye appeal and serviceability, assist in making sales and must be so exactly adapted to the production process that the finishing cost per unit of production is minimum. This point of view, together with a comprehensive technical knowledge of materials, manufacturing processes, and service conditions, has qualified him to serve industry with exceptional success.

Mr. Klinkenstein is a native of New York. In 1916, he entered the employ of the company which he now directs. His first job was one which would have little appeal for the average person. Maas & Waldstein were one of the pioneer producers of nitrocellulose, and,

when the World War broke out, they opened a plant for the manufacture of guncotton, first for the British, and later for the French government. Mr. Klinkenstein was assigned to guncotton work and showed so much promise as a manufacturing and research chemist, he was retained by Maas & Waldstein when guncotton production was ended.

He became Chief Chemist for the company in 1922 and Technical Director in 1928. In 1936, he was made Vice-President, Secretary, and General Manager. Under Mr. Klinkenstein's direction and largely as the result of his own research work, the M & W line of products expanded from a few clear lacquers for protecting polished metals to industrial finishes of every type.

Mr. Klinkenstein has taken out a number of patents on crystallizing and other lacquer products and processes, and has presented numerous papers before the Paint and Varnish Division of the American Chemical Society and other technical organizations. He is a member of the American Chemical Society, the Progress Club of Newark, and the Unity Club of Maplewood. He resides in Maplewood, New Jersey.

Dr. C. B. F. Young

Dr. C. B. F. Young, who recently resigned as Technical Director of the U. S. Research Corporation, Long Island City, N. Y., has been appointed



DR. C. B. F. YOUNG

Lecturer in the Department of Chemical Engineering at New York University. On receiving his B.S. degree from Howard College, Birmingham, Alabama, he was appointed head of the Lecture Demonstration division, Department of Chemistry, Columbia University. This position was held for two years and on resigning he was appointed assistant curator of the Chandler Chemical Museum which position he held for a two year period. In 1934 he was invited to join the staff of the U. S. Research Corporation as Technical Director which position he held until his recent resignation. He has the rank of Instructor at Columbia University teaching in the division of electrochemistry under Professor Colin G. Fink. At this institution Dr. Young conducts courses designed to aid the electroplater in practical and research work and electrochemistry. Last fall he was invited to join the staff of New York University, having charge of the electrochemical division of Chemical Engineering.

Dr. Young, besides his teaching duties, is now actively engaged in consulting. He has been retained by the following companies: Premier Metal Etching Company, Sperry Gyroscope Company, Lionel Corporation and Hilo Paint and Varnish Corporation.

Dr. Young is a member of The Electrochemical Society. For the American Society for Metals, he wrote the section on metal coloring in their Handbook for 1936. He is the author of some twenty-five papers dealing with various subjects on electroplating, electrometallurgy, metal coloring, health hazards, and chemical engineering.

T. C. Eichstaedt of the Detroit Branch of the American Electro-Platers' Society has been appointed by President Thompson to be chairman of the Mem-



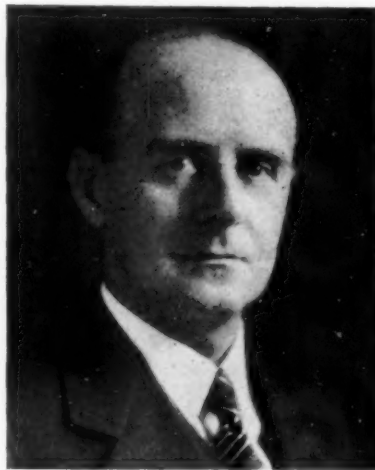
T. C. EICHSTAEDT

bership Committee, to fill the office left vacant by the late P. J. Sheehan of Milwaukee Branch; also the office First Vice-President of the Society.

O. W. Ellis

O. W. Ellis, who is to present the American Foundrymen's Association paper before the 1937 meeting of the Institute of British Foundrymen, is director of metallurgical research, Ontario Research Foundation, Toronto, Canada.

An active worker of many commit-



O. W. ELLIS

tees of A.F.A., Mr. Ellis is noted for his many contributions along research lines. Some of the subjects he has covered include high strength brasses, bearing metals, heat treatment of steel, and forgeability of metals.

He was born in Swindon, England, and received his technical training at the University of Birmingham, England, being graduated with the B.Sc. degree in 1914 and the M.Sc. degree in 1917. From 1905 to 1910, Mr. Ellis served as apprentice for the Great Western Railway at Swindon, and in 1910 and 1911 he was assistant to the supervisors of apprentice of the Canadian Pacific Railway, Montreal, Canada. From 1914 to 1921 he was metallurgist, Royal Ordnance Factories, Woolwich, England. In 1921 Mr. Ellis returned to Canada to accept the position as assistant professor of metallurgical engineering at the University of Toronto, remaining with this University until 1925. At this time he was appointed Industrial Fellow at Mellon Institute, Pittsburgh, Pa. From 1926 to 1929, Mr. Ellis held a position as research metallurgist with the Westinghouse Electric and Mfg. Co. at East Pittsburgh. In 1929, he returned to Canada to accept his present position.

Mr. Ellis is a member of the A.F.A., Institute of Metals, Iron and Steel Institute, American Society of Mechanical Engineers, American Society for Metals, American Society for Testing Materials, Society of Automotive Engineers, and the American Institute of Mining and Metallurgical Engineers.

W. Roland Peters has taken over the management of the firm of James Peters

& Son, hardware manufacturer, at 1934 N. Front St., Philadelphia, Pa., following recent death of William Peters.

C. C. Carr, formerly in charge of public relations for Aluminum Co. of America, Pittsburgh, Pa., has been appointed advertising manager for the company. Mr. Carr succeeds **W. C. White**, who has been advertising manager for the last eight years. Mr. White will devote his entire time to his duties as president of the Aluminum Cooking Utensil Co., Edgewater, N. J.

E. C. Felton has been elected vice-president of the Hunt-Spiller Mfg. Corp., Boston, Mass. He has been with the company 19 years, first as assistant to vice-president and later as assistant treasurer.

H. R. Weller has been appointed district sales manager at Cleveland by **General Refractories Co.**, Philadelphia, Pa., succeeding **J. C. Hopkins**, who has resigned to become associated with **Wellman Engineering Co.**

Federated Metals Division of American Smelting & Refining Co., 120 Broadway, New York, announce that **I. Glueck** is appointed manager of New York, Newark and Perth Amboy operations, and that **Max Robbins** is appointed manager of Chicago operations.

R. J. Morrow, for the past nine years research engineer for **United Chromium, Inc.**, Waterbury, Conn., has purchased the **Ashtabula Chrome Plating Co.**, Box 395, Ashtabula, Ohio, which specializes in the production of wear resistant chromium deposits on tools and machine parts, both for increasing life and reclaiming undersize parts.

A. J. Field, for the past seven years consulting engineer at the office of **Arthur Seligman & Co., Inc.**, 30 Rockefeller Plaza, New York City, sole importers of the products of **The British Aluminium Co., Ltd.**, has returned to England to assume an important position at the Company's Works. He is succeeded by **J. C. Jones** who recently arrived from England where he was for some years metallurgist on the staff of **The British Aluminium Co., Ltd.**

G. A. Ruehmeling, formerly manager of sales and engineering of the **General Plate Co.**, Attleboro, Mass., has become identified with the **Schrumm Process Co.**, 25 Calhoun Ave., Providence, R. I., who make equipment used for brazing and bright annealing.

C. M. Houck, formerly manager of the inspection division of Pittsburgh Testing Laboratory, Pittsburgh, Pa., was elected vice president at the January meeting of the Board of Directors. His predecessor in the Vice Presidency, **A. R. Ellis**, was recently elected President.

Obituaries

David M. Ireland

David M. Ireland whose death was noted in our February issue, was born in New Paris, Ohio, March 15, 1851. He left a widow, Mrs. Emma Schlegel Ireland, two daughters, Mrs. Stapleton and Mrs. Straw, two sons, David B. and William C. Ireland, 11 grandchildren and 1 great grandchild.

He came to Waterbury, Conn., from Chicago to take charge as superintendent of the Matthews & Willard Co. in



DAVID M. IRELAND

1877. In 1889 at the request of G. H. Barbour and James Dwyer he started the Ireland and Matthews Mfg. Co., to supply stove parts and trimmings and also brass spinings and stampings. He was director of the Renown Stove Co. in Owosso for many years, president of Wolverine Bolt Co. and Detroit Metal Specialty Co. The last named was absorbed by Eaton Detroit Metal Co., Cleveland, Ohio. Mr. Ireland was instrumental with G. H. Barbour in organizing the Michigan Copper & Brass Co. in 1906.

W. G. Lathrop in his book *The Brass Industry in the United States*, stated that David M. Ireland of Waterbury, with his experience in brass mills was one of the leaders in brass manufacturing industry in the West. He had faith in the future, built wisely and successfully.

In *Metal Industry* for December 1924 was published an article describing the Michigan Copper & Brass Co., of which Mr. Ireland was president.

Patrick J. Sheehan

Patrick J. Sheehan whose death was noted in our February issue was born in Ireland in 1881. In 1890 he came to America. He was graduated from St. Mary's and Crosby High School, Waterbury, Conn.

Mr. Sheehan had wide experience in the electroplating industry. He was with Booth & Hayden, Scoville Mfg. Co., General Electric Co. at Pittsfield,

Mass., where he had charge of finishing, and lastly with Cutler-Hammer Inc., Milwaukee, Wisc., where he took charge of plating and polishing departments in 1910. He remained there as superintendent of metal finishes until his death, January 9, 1937.

Mr. Sheehan had varied interests outside of his work. He was prominent in amateur and professional athletics, especially football, boxing and bicycle racing. He was active in the American Electro-Platers' Society all of his professional career, helping to organize the Milwaukee branch. At the time of his death he was national vice-president.

Mr. Sheehan's death which was caused by coronary thrombosis, came suddenly after a normal day's work. He is survived by his widow, Mrs. Mary E. Sheehan, two sons, Vincent and Edward, and two sisters, Mrs. Mary Ryan and Mrs. Catharine Sullivan.

Frederick G. Yawman

Frederick G. Yawman, 64, president-manager of Yawman Metal Products, Inc., 15 Elser Terrace, Rochester, N. Y., and an inventor of tool machinery, died recently after a five-day illness.

Mr. Yawman, who lived at 219 West Avenue, was born in Rochester and attended St. Peter and Paul's parochial school. As a youth he worked in Yawman & Erbe Mfg. Co., later going to the Camera Works on State St. as tool room foreman. When he left the Eastman Co. in 1907, he was assistant to F. A. Brownell, then Camera Works manager.

Shortly after, Mr. Yawman and Charles Eisler established a firm in Elser Terrace. In 1910 Mr. Eisler left the firm and Mr. Yawman operated it alone until graduation of his son, Victor, from college, the younger man joining as a partner. Nine years ago the firm name was changed to that which it now bears. Mr. Yawman was issued several patents on the fabrication of metal products.

He was a member of the Leiderkranz, the Knights of Columbus, the Holy Name Society and the Chamber of Commerce.

Surviving him, besides his son, are two sisters, Mrs. Frederick Leonard and Effie Yawman, three grandchildren.

William C. Foster

William C. Foster, vice president of the Theodore W. Foster Brothers Company, manufacturing jewelers and silversmiths, died suddenly at his home here on February 4 following a short illness from pneumonia. He was in his 60th year.

Mr. Foster, who had been in the manufacturing jewelry industry nearly all his business life, was born in this city June 20, 1877, the son of the late Theodore W. Foster. Educated in the private and public schools of his native city, he attended Brown University for a few months as a member of the class of 1902. He is survived by his widow, one son, three sisters and twin grandchildren.

William P. Bowman

William P. Bowman, 69, of South Branch, N. J., vice president and treasurer of the John A. Roebling Sons Co., of New York City, died January 22 in a New York hospital. He had been ill but a few days. He was the son of James Bowman, a captain in the Civil War. In 1892 he became associated with the Roebling Company. He opened a branch house for the company in Cleveland and remained there as manager until 1909. He was then transferred to New York and elected to the position of vice president and treasurer. He was also president of the Durable Wire Rope Co., of Boston, Mass. He was a leader in Republican affairs, but never held office. He was a member of the Masonic Fraternity, the Elks and the Raritan Valley Country Club. He was also affiliated with the Engineers and Railroad Clubs and the Bankers of America. He is survived by a son and three brothers. Burial was in Cleveland, O.—C. A. L.

Metal Developments

World production of aluminum in 1936 is estimated at 358,700 tons, an increase of 100,700 tons over 1935. United States showed the largest increase producing 102,027 tons, an increase of 47,915 tons over 1935.

One of the dangers to which the inhabitants of the flood regions are exposed is the threat of a typhoid epidemic where the water supply has been polluted. The United States Public Health Service is shipping sufficient vaccine to immunize the population in the endangered areas. Production of vaccine is made under absolutely sterile conditions in glass and monel lined cubicles. Monel

is also used extensively for equipment within the cubicles, and also for the barrels in which batches of vaccine are mixed for standardization.

A new construction cementing material has been described by Dean S. Hubbell of the Mellon Institute of Industrial Research in "Industrial and Engineering Chemistry." This cement consists of magnesium oxychloride cements to which 10% of finely divided copper powder has been added.

The American Welding Society, 29 W. 39th Street, New York, announces the acceptance by the Board of Direc-

tors, of a gold medal to be known as the "Lincoln Gold Medal" to be presented to the author of the best paper on any phase of welding, published in the Journal of the American Welding Society during the year October 1936 to October 1937. This medal is made available through J. F. Lincoln, President, The Lincoln Electric Co., Cleveland, Ohio.

The James F. Lincoln Arc Welding Foundation, has been established (P. O. Box 5728, Cleveland, Ohio). This Foundation will distribute \$200,000 among the winners of 446 separate prizes for papers dealing with arc welding as a primary process of manufacture, fabrication or construction in 11 major divisions of industry. Prizes will range from \$13,700 down to \$100. Full details can be obtained from the Foundation at the address given above.

A movement has begun in the jewelry manufacturing industry to stimulate American designs and styles for its products. A competition for American jewelry designs has been announced in which cash awards have been offered by the New England Manufacturing Jewelers' and Silver-smiths' Association, the Rolled Gold Platers' Association, the Metal Finding Manufacturers' Association, and the Manufacturing Jeweler, all of Providence, R. I. The Rhode Island School of Design, Providence, R. I., is playing an important part in the program.

Course in Non-Ferrous Metallurgy

The New York Chapter of the American Society for Metals presents an Educational Course in Non-Ferrous Metallurgy. Lectures by recognized authorities on copper, aluminum, nickel and alloys of industrial importance (metallurgy and practice). Industrial applications and theory of precipitation hardening. Fundamentals of welding copper and its alloys.

The Chapter offers for these lectures speakers whose wide practical experience and theoretical knowledge qualify them as authorities in their respective fields. The course presents to men engaged in metal industries a rare opportunity to broaden their knowledge at a minimum cost.

Lecture Schedule

Mar. 1, 1937—**Metallography of Copper and Brasses.**

F. H. Clark, Western Union Telegraph Co., New York City.

Mar. 8, 1937—**Metallography of Bronzes and Special Copper Alloys.**

Cyril S. Smith, American Brass Co., Waterbury, Conn.

Mar. 22, 1937—**Metallography of Aluminum and Its Alloys.**

R. M. Brick, Yale University, New Haven, Conn.

Mar. 29, 1937—**Metallography of Nickel and Its Alloys.**

D. E. Ackerman, International Nickel Co., Research Laboratory, Bayonne, N. J.

Apr. 5, 1937—**Precipitation Hardening.**

J. T. Eash, International Nickel Co., Research Laboratory, Bayonne, N. J.

Apr. 12, 1937—**Fundamentals of Welding Copper and Copper Alloys.**

Ira T. Hook, American Brass Co., Ansonia, Conn.

Meeting Place—Metal Products Exhibit, 3rd Floor—International Building, Rockefeller Center, 630 Fifth Avenue.

Time—Monday, 7:30 P. M., promptly.

Registration

Members of A.S.M.—Free.

Sustaining Members—Two representatives free.

Non-members—\$5.00 for the course. This fee may be credited toward membership in A.S.M. if applied for during course.

Students—\$2.50 for the course, which includes cost of Junior Membership in A.S.M.

For further information communicate with J. R. Vilella, Chairman of the Educational Committee, U. S. Steel Corporation Research Laboratories, Kearny, New Jersey, telephone Market 2-3150 or see Mr. Vilella at the meeting place on the evening of the first lecture.

Corporation Earnings

New Profit Unless Followed by (L) Which is Loss

	1936	1935
Bristol Brass Corp.	\$327,519	\$327,834
Cleveland Graphite Bronze Co.	1,238,659	1,273,117
Federal Mogul Corp.	398,086	209,264
International Silver Co.	430,624	496,687 (L)
Landers, Frary & Clark	811,560	584,029
National Bearing Metals Corp.	701,212	433,343
National Lead Co.	7,232,530	5,261,390
N. J. Zinc Co.	5,250,789	4,666,000
Ohio Brass Co.	918,261	348,992
Oneida, Ltd.	609,447	640,718
Parker Rust Proof Co.	1,082,146	952,819

Business Items-Verified

Square D Co., 6060 Rivard St., Detroit, Mich., manufacturers of electric switches, circuit breakers, etc. have asked bids on general contract for four and five story addition. Cost over \$125,000 with equipment. Departments: tool room, stamping, galvanizing, brazing, lacquering, japanning.

Alsop Engineering Corp. is now settled in its new home in Milldale, Conn. on a 10½ acre property with building containing over 60,000 sq. ft. floor space on one level. General offices are also located at the factory and the executive personnel have located their homes in the vicinity of plant. The New York office and showroom is still maintained with a service department for the whole metropolitan area at 17 W. 60th St., New York.

Grand Rapids Varnish Corp., Grand Rapids, Mich., has plans for a 2-story addition, 60 x 100 feet. Cost about \$55,000 with equipment.

The **Claude B. Schneible Company**, Chicago, Ill., makers of Multi-Wash Dust Collectors and Multi-Louvre Dewatering Tanks, recently announced the appointment of two new sales representatives in the Milwaukee and Eastern Pennsylvania territories. **Paul J. Cnare** will handle sales in Wisconsin and

Minnesota from headquarters in Milwaukee. **Charles C. Hermann** will be in charge of the Philadelphia office which covers Eastern Pennsylvania, Maryland, Delaware, and the lower New Jersey territory.

Swartz & White Mfg. Co., Binghamton, N. Y., manufacturers of flexible shafts are now in full operation in new and larger quarters at 215 Washington Street. The old plant at 243 Water Street was completely destroyed by fire on November 24. Departments: tool room, casting shop, rolling mill, grinding, polishing and buffing.

Art Tube Co., 8 Renee Pl., Irvington, N. J., manufacturers of collapsible metal tubing, etc., have plans for new one-story and basement plant, 145 x 150 ft. Cost close to \$100,000 with equipment. Departments: tool room, casting shop, rolling mill, spinning, stamping, metal spraying, grinding, lacquering and enameling.

Martin Bros. Electric Co., 1858 E. 40th St., Cleveland, Ohio, manufacturers of electrical appliances and equipment, have acquired approximately 32,000 sq. ft. of vacant land in Perkins Ave. Plans are in progress for erection of a two-story and basement brick and steel factory, comprising about 25,000 sq. ft.

floor space to afford company 20% more manufacturing space. Construction work was started in January. Departments: tool room, spinning, stamping, metal spraying, polishing and buffing, lacquering.

Wolverine Tube Co., 1411 Central Ave., Detroit, Mich., manufacturers of seamless brass and copper tubing, pipe bends, etc., have let general contract for one-story addition. Cost over \$45,000 with equipment. Departments: brass, aluminum foundry; tool room, casting shop, soldering, brazing, tinning and electroplating.

McCall Refrigerator Co., Hudson, N. Y., have been organized to manufacture metal display cases including the refrigerator type finish in porcelain enamel. They are interested in catalogs of houses selling sheet metal forming machinery, and houses doing sheet metal forming work.

Laminated Metals Corp., 775 Eddy St., Providence, R. I., have been organized to manufacture thermostatic metals and other laminated metals, such as silver contact points. **B. W. Dezotell** is manager of the Thermostatic Metals Div. Departments: rolling mill and soldering.

Bausch & Lomb Optical Co., Rochester, N. Y., have opened a new laboratory for applied research in the fields of metallurgy, experimental electroplating, spectroscopy, photomicrography and physical testing. The laboratory will be in charge of **T. B. Drescher**, vice-president, who will be assisted by **F. P. Kolb**, chief chemist, and **T. J. Zak**, assistant chemist. Other members of the staff are **R. A. Kirchmaier**, **J. T. Anderson** and **Dr. E. M. Webb**.

Tube-Turns, Inc., Louisville, Ky., have moved to new and larger quarters at 224 E. Broadway, Louisville, Ky.

Homestead Valve Mfg. Co. Inc., Coraopolis, Pa., announce the return of **Elliott G. Johnson** as advertising manager, after a four-year leave of absence, during which he was serving the Government as ordnance engineer with the Navy.

Gar Wood Industries, Inc., Detroit, Mich., announce appointment of **D. J. Luty** to position of assistant general manager, and **N. Saylor** as manager of the company's Detroit branch.

Contract Plating Co. Inc., metal finishing, announce the removal of plant and offices to 540 Longbrook Ave., Stratford, Conn.

The executive offices and New York sales offices of **Swan-Finch Oil Corp.** have been moved from 205 E. 42nd St., New York, to larger and more centrally located offices at 30 Rockefeller Plaza, New York.

The **Beardsley & Piper Company**, Chicago, Ill., makers of sandslingers,

sand conditioning machinery, and foundry handling equipment, have recently announced several additions to their sales organization. **George Furman** has returned to the organization in the capacity of sales engineering and is handling a part of their Eastern sales territory in Pennsylvania and New York State. **S. S. Swasey**, a newcomer to the organization, augments their sales engineering staff throughout the country, being available for consultation and engineering service in all territories. **J. J. Walsch** joins the Beardsley & Piper organization as a demonstrator.

The **Mine Safety Appliances Company** of Pittsburgh, Pennsylvania, today announced the formation of **The Mine Safety Appliances Company of Canada, Ltd.**, a new company, which took over the personnel and business of the safety department of **Drummond, McCall & Company, Ltd.**, of Montreal, Quebec, well known successful merchants dealing in iron, steel and non-ferrous metals for the past fifty years. The safety department of Drummond, McCall had been the agents for the Mine Safety Appliance Company since 1918. The new company which is located at 802 Railway Exchange Bldg., 637 Craig Street, West, Montreal, P. Q., is in charge of **R. Morris** former manager of the Safety Division of the Drummond, McCall & Company, Ltd. **R. M. McCall** will represent the new company in Nova Scotia with office and warehouse at New Glasgow. Complete stocks of MSA safety equipment will be carried at Montreal, P. Q., and New Glasgow, Nova Scotia.

Mine Safety Appliances Company will shortly occupy the large new building which has been added to its plant at Braddock, Thomas and Meade Streets, Pittsburgh, Pa.

One hundred and ninety-nine employees of the **Metal Specialty Company**, of Cincinnati, Ohio, have recently become eligible to life insurance in amounts ranging from \$1,000 to \$3,000 each, according to rank. The policy, which involves a total of \$238,000, was issued by the Prudential Insurance Company of America on the contributory basis, the employees themselves paying a part of the premium and the remainder of the expense being assumed by the employing company.

The **Lincoln Electric Company**, Cleveland, Ohio, announce three appointments to the sales staff of their Chicago office, 1455 West 37th Street. The men appointed include **Robert A. Wilson**, **George Mandula** and **A. T. Cox, Jr.**

The **Ideal Commutator Dresser Company**, 1940 Park Avenue, Sycamore, Illinois, manufacturers of quality electrical products, announce the acquisition of the **Marshall Electric Company** of Elkhart, Indiana, manufacturers of

automatic regulators for voltage, current and speed control of electrical equipment. Operations of the acquired company will be transferred as rapidly as possible to Sycamore and consolidated with the main office, production, engineering, research and development departments of the Ideal Commutator Dresser Company.

The **Lincoln Electric Company**, Cleveland, Ohio, announce the appointment of **B. J. Brugge**, who spent two years superintending welding operations in the Near East, to the sales staff of its Los Angeles, California office.

The **Penn Metal Company, Inc.**, have opened a Philadelphia Sales Office at 2402 Market Street, and **M. J. McCarthy** is in charge as District Manager. Mr. McCarthy has had wide experience as a sales engineer in metal lath with Penn Metal products during the past ten years.

Four Lakes Ordnance Shop at 2810 Atwood Ave., Madison, Wisc., has been purchased by **Thomas E. Coleman** and **Joseph A. Coleman**. This shop adjoins plant of the Madison-Kipp Corp.

Officials of the **Light Alloys Co.**, Painesville, Ohio, whose factory was destroyed by a \$60,000 fire recently, announced that no decision has as yet been made as to whether they will rebuild. The company manufactured aluminum castings and much of its work was for automobile concerns.

Airtemp, Inc., Dayton Ohio, manufacturer of air-conditioning equipment and parts, a subsidiary of Chrysler Corp., Detroit, will carry out plant expansion and improvements, including additional machinery. Cost over \$400,000 with equipment. This firm operates the following departments: tool room, stamping, soldering, brazing, grinding and enameling.

Tavella Sales Co., 25 W. Broadway, New York, have acquired all tools, dies and manufacturing rights for the Arithmometer adding machine especially adapted for carrying in the vest pocket or ladies hand bag, from the Morse Chain Co. of Ithaca, N. Y.

S. G. Adams Metalware Co., 2940 Franklin St., St. Louis, Mo., manufacturer of sheet and pressed metal products has let contract for a one-story addition, 58 x 62 ft. Cost over \$40,000 with equipment. This firm operates the following departments: stamping, soldering, brazing, polishing and buffing, electroplating, lacquering, japanning and enameling.

Emerson Electric Mfg. Co. Inc., St. Louis, Mo., have appointed **Eugene P. Farris** manager of specialty sales, succeeding **H. L. Parker Jr.**, who has resigned. The Specialty Division has charge of the sales of Emerson Electric direct-connected, multi-speed blowers,

exhaust fans, ventilating fans, furnace fans, circulator heater fans and temperature actuated controls for air conditioning systems. Departments: brass machine shop, tool room, cutting-up shop, stamping, soldering, brazing, tinning, grinding, polishing and buffing, lacquering, japanning, enameling.

Atlas Brass Foundry Inc., is having plans drawn for new \$50,000 building. The factory will be erected at the company's present site, 1901 Santa Fe Ave., Los Angeles, Calif. According to officials of the concern the \$50,000 will represent actual building costs only and not include expenditures on new equipment. This firm operates bronze, brass and aluminum foundry.

Harris Plating Works, Ltd., 29-30

Glasshouse Yard, London, E. C. 1, England, have extended a cordial invitation to principals of electroplating firms and electroplating supply firms visiting London, to look over their plant. They will be glad to return the many courtesies shown them when they visited the United States a few years ago.

Gar Wood Industries, Inc., Motor Coach Div., Detroit, Mich., announce the appointment of **H. Sydney Snodgrass** as manager of the motor coach division to fill the vacancy created by the resignation of **Stanley E. Knauss**.

J. R. Hoover for the past six years assistant manager of chemical sales for the Mechanical Rubber Goods Divi-

sion of the **B. F. Goodrich Co.**, Akron, Ohio, has been made manager of this department. He takes over the duties of **Dr. H. E. Fritz** who will devote his entire efforts to the sale and development of **Koroseal**, a new synthetic elastic material recently introduced by Goodrich.

La Banque Economist Trust Co., of 4, rue Fresez, Luxembourg, ask the *Cape Times* to make known that it wishes to enter into business relations with firms owning any of the many varieties of ore that contain Beryllium. The company asks to be supplied with quotations f.o.b. export harbors, and states that it is prepared to furnish capital for the development of mines containing such ores.

News From Metal Industry Correspondents

New England States

Waterbury, Conn.

February 26, 1937.

Local factories increased employment by 120 during January. The total employment figure was 36,803 at the end of that month, a figure greater than in any year since the World War. The figure is 4,748 more than a year ago. Bank clearings for the month showed a decrease of \$703,700 compared with December but an increase of \$1,412,000 compared with a year ago. Freight tonnage for the city during the month 57,500 tons received and 13,000 tons forwarded, an increase of 1,600 tons in the tonnage forwarded.

Directors of the **Chase Brass & Copper Co.** were reelected last month and they in turn reelected the officers. They are as follows: **President, Frederick S. Chase**; vice-presidents, **Robert L. Coe**, **Richard D. Ely** and **J. R. Van Brunt**; vice-president and secretary **Charles E. Hart, Jr.**; treasurer, **John H. Gilbert**; assistant secretaries, **Rodney Chase**, **Edward H. Madison**, **S. S. Jackson**, **C. K. Lenz** and **W. L. Smith**; assistant treasurers, **Louis J. Schuster**, **Robert C. Smith** and **V. W. Heyden**; directors, **F. S. Chase**, **E. T. Stannard** (president of the **Kennecott Co.**), **R. D. Ely**, **R. L. Coe**, **Rodney Chase**, **J. H. Gilbert**, **Fred A. Jackle**, **J. R. Van Brunt** and **C. T. Ulrich** (vice-president and treasurer of the **Kennecott Co.**).

The **Benrus Mfg. Co.** is negotiating for the purchase of the five-story building on Cherry Street in which it is now located. This was formerly the crystal factory of the **Waterbury Clock Co.** but is now owned by the **Industrial Properties, Inc.** The **Benrus Co.** leased three of the floors in 1934 for three years with an option to buy the entire building for \$75,000. It is understood

the company is now going to take up this option. The company manufactures watch ornaments in the local plant which are sent to its main plant in New Jersey where they are attached to the watches and clocks the company makes there.

Contracts awarded by the U. S. government last month which come within the terms of the Walsh-Healy public contracts act included one to the **American Brass Co.** for \$59,505 worth of brass and copper pipe, another to that company for \$23,730 and one to the **Chase Brass & Copper Co.** for \$69,286 worth of brass.

Seven employees of the **Chase Brass & Copper Co.** who have been with the concern over 50 years were guests at a dinner given by the company Feb. 13. One of them was **James Wigmore** who was referred to by **Pres. F. S. Chase** as his "boss" as he was the foreman of the department where Mr. Chase worked when he first came to the company. Mr. Chase announced that within eight months he could qualify as a 50 year employee.

The **Lumin-Art Display Co.**, of Brooklyn, N. Y. has leased 40,000 feet of floor space in the now closed **American Mills Co.** plant on Mill Street and expects to employ about 250 persons in the manufacture of advertising signs.

The mayor and the city comptroller have drawn up a program which aims at bringing new industries to the city. The first step is making a survey of all idle factory buildings and empty buildings adapted to manufacturing. Special effort will be made to interest owners of small, light manufacturing businesses, emphasizing the low water rates here, the city's freedom from labor troubles and the excellent freight and transport facilities.—**W. R. B.**

Connecticut Notes

February 26, 1937.

HARTFORD—Directors and officers of the **Billings & Spencer Co.** were reelected at the annual meeting in February. **Pres. F. C. Billings** reported a net profit of \$19,774 for the last six months compared with a loss of \$11,492 for the same period last year.

The **Atlantic Screw Co.** announces the election of **Roy W. Johnson**, factory superintendent, as vice-president, and the election of **Ass't Sec'y Samuel Monks** as secretary, filling the vacancy caused by the death of **Morton F. Miner**.

BRIDGEPORT—The **General Electric Co.** has purchased that part of the plant of the **Remington Arms Co.** bounded by Barnum Avenue, Seaview Avenue and Boston Avenue at a price of approximately \$525,000.

BRISTOL—Approximately 7,200 employees of the **New Departure Co.** shared in the 5c an hour increase given **General Motors** employees. About 200 employees who had been on short time because of the G. M. C. strike are now on full time and the plant is operating at capacity.

NAUGATUCK—The **Risdon Mfg. Co.** has purchased **Consolidated Safety Pin Co.** of Bloomfield, N. J. from the **Chase Brass & Copper Co.** of Waterbury. The Chase Company acquired it about four years ago. **Lewis A. Dibble**, president of the **Risdon Co.**, says it is planned to move the New Jersey business here. Several months ago the local concern purchased the **Smith & Griggs Co.** of Waterbury. The machinery from Bloomfield will be divided between the Waterbury and Naugatuck plants and the 150 employees of the New Jersey plant will be similarly divided between these plants.

THOMASTON—**Seth Thomas Clock Co.** officials are planning a new four-story factory addition to be completed by fall. The Marine division of this place and the **Stromberg Electric Co.** of Chicago will be moved into the new

plant. Business is improving and many new employees have been hired.

WINSTED—Directors of the **W. L. Gilbert Clock Co.** were reelected in February and they reelected **Ralph E. Thompson** as president. He was also made treasurer, the post having been made vacant by the death of **R. J. Leighton**. All other officers were reelected.

—**W. R. B.**

Providence, R. I.

February 26, 1937.

Payrolls of workers in the non-ferrous metal trades group of Rhode Island industries averaged 72.3 per cent higher during the opening month of this year than in January, 1936, totalling \$306,580 which was also an increase of 11.8 per cent over the total for the month of December. This was the largest upturn shown in any group of industries, according to figures compiled by the **Brown Bureau of Business Research**.

Chemical Products Corporation is installing three steel storage tanks at their plant, rear of 55 Pawtucket Avenue, Rumford, in East Providence. Each will have a capacity of 6,500 gallons and will cost \$2,500 each. They will be used for the storage of lacquer solvents.

Anthony Saccoccio of 1534 Painfield Street, Thornton has filed statement of ownership of the **Modern Jewelry Casting Company** at 83 Page Street, Providence.

The **Metwood Company, Inc.** of Narragansett has been granted a charter for the manufacturing of wooden and metal fixtures. The incorporators are: **Ilse Swan**, of East Greenwich; **Gordon L. Swan** and **George R. Swan**.

Lacquer Rhode Island Company, of East Providence has been granted a charter to manufacture and deal in lacquers, varnishes, etc. The incorporators are: **E. H. Squire**, **N. W. Read** and **Charles P. Sisson**.

Glines & Rhodes, an old North Attleboro gold refining business, has been sold by its owner, **Mrs. Mary E. Rhodes**, to **Ralph Crowell** and **H. John Straker**. Death claimed the three members of the **Glines & Rhodes** firm within a two year period. They were **Albert B. Glines**, **Charles E. Rhodes** and **J. Thompson Rhodes**.

The manufacturing jewelry establishment of **A. J. Dennison & Co.**, Riverside, was broken into on the night of February 13, two safes ripped open and finished and unfinished stock valued at \$2,600 and \$79.32 in cash stolen.

Joseph A. Fogarty has filed statement of ownership of the **International Chromium Plating Co.** at 36 Garnet Street.

An order putting into effect on March 1st the minimum wage of thirty cents hourly for women and minors in the manufacturing jewelry industry was sent on February 17 to 290 firms in Rhode Island by **Thomas F. McMahon**, State Director of Labor, who estimated that 8,700 of the 14,500 employees in the industry would be affected.

—**W. H. M.**

Middle Atlantic States

Utica, N. Y.

February 26, 1937.

Upstate New York reported good business this past month with advancing prices in a number of lines.

In some industries men who had not been at their benches in half a dozen years were back while in the four major industries in Utica the employment figures are up 17 per cent over one year ago in January.

Effort is being made by the Chamber of Commerce to bring to Utica an air conditioning and ventilating manufacturing plant now located on the East Coast which would employ 3,000 men.

Charles Millar & Son, manufacturers of lead pipe and plumbing supplies, report that business is unusually good and that they have been forced to advance the price on a number of articles.

In Rome where brass and copper are the major raw materials the plants are working steadily with larger orders reported.

Some industries report difficulty in getting raw material and while factories have placed orders with the source of their supply they are told in many cases that the orders will be placed on file but no promise of delivery is made.

Plants in Utica, Rome and the towns in the Mohawk Valley, Herkimer, Ilion, Mohawk and Little Falls report the

benefit of the upswing. At Ilion for the first time in years the streets are jammed at night with the automobiles of the Remington-Rand workers.

—**E. K. B.**

Newark, N. J.

February 26, 1937.

The **Trio Aluminum Foundry Co.**, Hillside, has been granted permission by the zoning board to construct an addition to its factory at that place. The **Continental Can Co.**, New York, plans an addition at the Jersey City plant to cost \$40,000.—**C. A. L.**

Trenton, N. J.

February 26, 1937.

The strike in the automobile industry had little effect upon the metal trades in Trenton. The metal industry plants in Trenton and vicinity report a general increase in business with good prospects for the spring trade.

The plant of **Robert Clark**, brass manufacturer, Trenton, was recently slightly damaged by flames.

The following concerns were incorporated at Trenton; **Super-Leader Spark Plug Co.**, West New York, 100 shares, no par; **Joseph Waldman**, watch crowns, Irvington, 250 shares, no par; **Berlenbach Foundry Co.**, Millburn, \$50,000 preferred, \$75,000 common.—**C. A. L.**

Middle West

Cleveland, Ohio

February 26, 1937.

This area is just emerging from the effects of the recent strike in the motor car industry and it looks now as if production in the plants wherein metals are concerned would proceed with unabated energy for a period of several months. Prominent authorities declare that no important handicaps are pending and that the Spring and coming Summer should show remarkable developments.

Increased production also is about as favorable for those engaged in other lines outside the motor car industry. Plating plants seem to be favorably situated and are busy again with equipment taxed to capacity to keep up with demands.—**F. J. H.**

Detroit, Mich.

February 26, 1937.

With the truce in the motor car strike, came a quick resumption of production in many of the big plants in Detroit and the surrounding area. It was a tough nut to crack and it is now believed that the worst of the dispute is over.

The refrigeration industry, which holds an outstanding position in the metal trades also has settled its strike troubles and again is forging. This just about cleans up the labor troubles in the metal industries for the present, at least.

In spite of these handicaps now apparently over there has been an industrial urge in all lines of production and but for these labor difficulties, manufacturing would have been much farther advanced than they are at present.

The **Burroughs Adding Machine Co.** has started the erection of its new plant directly east of suburban Plymouth. This has been found necessary, it is stated, to relieve congestion at the main plant on Second Boulevard and Burroughs Avenue in Detroit. It is said the principal offices and main plant will remain at the present location the new structure to be used for its auxiliary production and expansion purposes.

Members of the **National Brass Forging Association** held its winter meeting in the Book Cadillac Hotel, here on Monday, Feb. 15. The Patman-Robinson bill as applied to industry was the main topic of discussion.

Directors of the **Mueller Brass Co.**, at Port Huron, Mich., announces an extra dividend of 10 cents a share and the regular quarterly dividend of 25 cents a share, both payable on March 29 to stock of record on March 10.

It is stated that the **Clayton & Lambert Manufacturing Co.** is about to erect a factory building on French Road in Detroit, which is to be 109 by 281 feet, of brick and steel, at an estimated cost of \$72,000.—**F. J. H.**

Pacific Coast

Los Angeles, Calif.

February 26, 1937.

The **Lockheed Aircraft Corporation** of Burbank have started work on a \$225,000 expansion of the factory, six new buildings to go up and plan to double the output.

North American Aviation of Inglewood will erect a \$225,000 addition to the factory to double the force and output.

O'Keefe-Merritt Co. built a large addition to the refrigerator factory at 3700 East 9th St.

The **Union Die Casting Co.** of this city appointed **Horace H. Allen** as northern representative, at 1499 Market St., San Francisco.

The **Boyle Mfg. Co.**, 5100 Santa Fe

Ave. are making a new line "Kool Kan" thermo cooling cabinet for foods.

The **Stovurn Co.** of 1415 Santa Fe Ave. have enlarged their plant for making coffee urns.

The **Nelli Art Bronze Co.** are building a new plant at 3426 Union Pacific Ave.

The **Boyertown (Pa.) Burial Casket Co.** started a factory here at Georgia St. and Venice Blvd. to make metal caskets.

Intellect - A - Ray Corporation was started here by A. Burns Smith, to make a commercial electric alarm system.

The **Troy Radio Mfg. Co.** started to make radio apparatus for cars, at 1815 Venice Blvd.—H. S.

Silver retained its seat in the background reclining quietly for the entire month at 44.75c per lb. oz. Troy.

Platinum which rounded out January at \$58 per oz. was raised on Feb. 1st to \$68. It maintained this post until February 15th when the leading interest reduced their price to \$63 effective Feb. 15. On Feb. 23 the price was again reduced, to \$58. No details of the reasons for up and downs were given.

Wrought Metal distribution during the past month is indicated by the report of a metropolitan distributor who reports that February was 30% above January and 60% above February 1936.

Scrap Metals had an exciting time. They were constantly faced with the fact that export bids were ahead of domestic levels, in spite of increased refiners' bids until the middle of the month when refiners increased their figures about 3/4c on scrap copper and about 1/2c on brass. Toward the latter part of the month, exporters were slower to follow the rise in price abroad.

The ingot business was naturally excellent. Brass and aluminum deliveries to users were consistently high, January brass ingot shipments totalling 10,022 tons, the highest figure since 1929. New bookings also climbed.

On February 1 the unfilled orders for brass and bronze ingots and billets on the books of the members of the Non-Ferrous Ingot Metal Exchange amounted to a total of 29,309 net tons.

The Institute reports average prices per lb. received by its membership on commercial grades of its principal mixtures of ingot brass during the 28 day period ending February 19th.

80-10-10 (1 1/2% Imp.)	15.965c
78% Metal	13.033c
81% Metal	13.292c
83% Metal	13.580c
85% Metal	13.820c
No. 1 Yellow Brass	10.903c

AVERAGE PRICES FOR METALS

Copper c/lb. Duty 4c/lb. FEBRUARY

Lake (del. Conn. Producers' Prices)	13.662
Electrolytic (del. Conn. Producers' Prices)	13.60
Casting (f.o.b. ref.)	13.558
Zinc (f.o.b. E. St. Louis) c/lb. Duty 1 3/4 c/lb.	

Prime Western (for Brass Special add 0.50-0.10)	6.435
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Tin (f.o.b. N. Y.) c/lb. Duty Free, Straits	51.937
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Lead (f.o.b. St. L.) c/lb. Duty 2 1/2 c/lb.	6.239
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Aluminum c/lb. Duty 4 c/lb.	20.500
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Nickel c/lb. Duty 3 c/lb. Electrolytic 99.9%	35.000
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Antimony (Ch. 99%) c/lb. Duty 2c/lb.	14.549
--------------------------------------	--------

Silver c/oz. Troy, Duty Free	44.75
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Platinum \$/oz. Troy, Duty Free	63.861
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Gold—Official U. S. Treasury Price \$/oz. Troy	35.000
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Metal Market Review

March 1, 1937.

Copper was one of the stars of a group of outstanding performers in February. Closing January at 13c per lb. Electrolytic, its position was decidedly delicate because of the active speculation in London. Domestic producers stood fast until the middle of February before they bowed to the inevitable and again placed their quotation slightly ahead of foreign, raising copper a full cent to 14c. This move was followed immediately afterward, however, by another boom which sent the foreign price to 17.125 cif European ports. During the last week, copper was raised another cent to 15 and is still nominally at that figure although very little metal is changing hands and according to reports, most of it at prices ranging up to 16c.

Reasons for the activity are: increased industrial buying; speculation; foreign government buying for future war needs. Probably all of them are true. At the present time copper is still quoted at 15c Connecticut Valley and not far from 16c cif. Domestic sales for January totalled 53,815 tons. February sales were 8,060; 19,816; 23,286 and 18,099, making a total of 69,261 tons.

January statistics, which it was feared would show large increases in foreign stocks showed a rise of only 1,447 tons and a decline of 18,694 in the United States as compared with the previous month.

Prospects, variable but on the whole, strong.

Zinc was an important member of the climber family. It closed January at 6c per lb., Prime Western E. St. Louis and movements into consumption continued large during February. Early in the month a rise in price was indicated, especially after the publication of the January statistics showing total stocks of 34,143 tons; much less than the current monthly rate of consumption, about 50,000 tons. The price rose from 6 to 6.25 and then to 6.40 with buyers nervous because of the tight statistical posi-

tion of the metal. Later the price climbed to 6.80 where it closed.

Sales week by week were 8,600 tons; 10,000 tons; 5,000 tons and about 6,000 tons, making a total of about 29,600. Supplies are somewhat limited particularly for nearby metal and the market is decidedly firm although increased output is likely to be in effect during the summer. Anaconda's electrolytic refinery is going into production after a long shut-down.

Tin was subject to the same speculative influences that affected copper, rising from about 50c per lb. Straits at the end of January to over 55c during the last of February. Practically none of this rise took place until last week when it arrived suddenly and became very steep. For most of the month, consumers were somewhat reluctant to buy in view of the large surplus stocks of tin but sellers were not anxious to dispose of their metal. About the middle of the month the sellers began to get the upper hand, with tin rising up to over 51 and in the last week the speculative activities on the London Metal Exchange forced the price up to 55.60. At the present time tin is selling for 55.25 with prospects indeterminate because of the conflicting influences of ample stocks, the prospect of increased production and active speculation.

Lead also joined the party, rising from 5.85c per lb. St. Louis to 6.35, most of the rise occurring during the last week. Buying during the first week was modest, 2,800 tons, due to the possibility that the stocks of refined metal would show an increase for January. Sales during the second week increased to 9,600 tons, were 7,000 tons in the third week, and the rise in price during the last week together with sales of 10,500 tons, were due to the January statistics which showed a decline in stocks of 2,080 tons. Total sales—29,900 tons.

Prospects firm.

Metal Prices, February 26, 1937

(Import duties and taxes under U. S. Tariff Act of 1930, and Revenue Act of 1932)

NEW METALS

Copper: Lake, 15.50-16, Electrolytic, 15-16, Casting, 15.75.
Zinc: Prime Western, 6.80. Brass Special, 6.90.
Tin: Straits 54.75.
Lead: 6.85. Aluminum, 19-22. Antimony, 16.50.
Nickel: Shot, 36. Elec., 35.

Duties: Copper, 4c. lb.; zinc, 14c. lb.; tin, free, lead, 2½c. lb.; aluminum, 4c. lb.; antimony, 2c. lb.; nickel, 3c. lb.; quicksilver, 25c. lb.; bismuth, 7½%; cadmium, 15c. lb.; cobalt, free; silver, free; gold, free; platinum, free.

Quicksilver: Flasks, 75 lbs., \$95. Bismuth, \$1.00.
Cadmium, 75c. to \$1.05. Silver, Troy oz., official price, N. Y., Feb. 26, 44.75c. Gold: Oz. Troy, Official U. S. Treasury price, \$35.00. Scrap Gold, 6¾c. per pennyweight per karat, dealers' quotation. Platinum, oz. Troy \$58.00.

INGOT METALS AND ALLOYS

	Cents lb.	Duty	U. S. Import Tax*
No. 1 Yellow Brass	12.75	None	4c. lb. ¹
85-5-5-5	16.50	None	4c. lb. ¹
88-10-2	20.25	None	4c. lb. ¹
80-10-10	18.125	None	4c. lb. ¹
Manganese Bronze (60,000 t. s. min.)	15.00	None	4c. lb. ¹
Aluminum Bronze	20.00	None	4c. lb. ¹
Monel Metal Shot or Block	28	25% a. v.	None
Nickel Silver (12% Ni)	17.00	20% a. v.	4c. lb. ¹
Nickel Silver (15% Ni)	19.50	20% a. v.	4c. lb. ¹
No. 12 Aluminum	19-25	4c. lb.	None
Manganese Copper, Grade A (30%)	24-30	25% a. v.	3c. lb. ¹
Phosphor Copper, 10%	18-20	3c. lb.	4c. lb. ¹
Phosphor Copper, 15%	19-21	3c. lb.	4c. lb. ¹
Silicon Copper, 10%	23-35	45% a. v.	4c. lb. ¹
Phosphor Tin, no guarantee	60-75	None	None
Iridium Platinum, 5% (Nominal)	\$62.00	None	None
Iridium Platinum, 10% (Nominal)	\$66.00	None	None

OLD METALS

Dealers' buying prices, wholesale quantities:	Cents lb.	Duty	U. S. Import Tax
Heavy copper and wire, mixed	13 to 13½	Free	4c. per pound on copper content
Light copper	11¼ to 11½	Free	
Heavy yellow brass	7¾ to 7½	Free	
Light brass	7¼ to 7¾	Free	
No. 1 composition	10¾ to 11	Free	
Composition turnings	10½ to 10¾	Free	
Heavy soft lead	6½ to 6¼	2½c. lb.	
Old zinc	4 to 4¼	1½c. lb.	
New zinc clips	5¼ to 5½	1½c. lb.	
Aluminum clips (new, soft)	14 to 14¼	4c. lb.	
Scrap aluminum, cast	12¼ to 12½	4c. lb.	
Aluminum borings—turnings	6¾ to 7	4c. lb.	None
No. 1 pewter	38 to 39	Free	
Electrotype	6¼ to 6½	2½c. lb.*	
Nickel anodes	26 to 27	10%	
Nickel clips, new	28 to 29	10%	
Monel scrap	8½ to 17	10% av.	

* Duty is under U. S. Tariff Act of 1930; tax under Section 60 (7) of Revenue Act of 1932.

¹ On copper content. ² On total weight. "a. v." means ad valorem.

* On lead content.

Wrought Metals and Alloys

The following are net BASE PRICES per pound, to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' price lists, effective since February 22, 1937. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 pounds; on nickel silver, from 1,000 to 2,000 pounds.

COPPER MATERIAL

	Net base per lb.	Duty*
Sheet, hot rolled	22¾c.	2½c. lb.
Bare wire, soft, less than carloads	19¾c.	25% a. v.
Seamless tubing	23¾c.	7c. lb.

* Each of the above subject to import tax of 4c. lb. in addition to duty, under Revenue Act of 1932.

NICKEL SILVER

Net base prices per lb. (Duty 30% ad valorem.)

Sheet Metal	Wire and Rod
10% Quality	10% Quality
15% Quality	15% Quality
18% Quality	18% Quality

ALUMINUM SHEET AND COIL

(Duty 7c. per lb.)

Aluminum sheet, 18 ga., base, ton lots, per lb.	32.80
Aluminum coils, 24 ga., base price, ton lots, per lb.	30.50

ROLLED NICKEL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Net Base Prices

Cold Drawn Rods	49c.	Cold Rolled Sheet	53c.
Hot Rolled Rods	44c.	Standard Sheet	48c.

MONEL METAL SHEET AND ROD

(Duty 25% ad valorem, plus 10% if cold worked.)

Hot Rolled Rods (base)	34	Standard Sheets (base)	38
Cold Drawn Rods (base)	39	Cold Rolled Sheets (base)	43

SILVER SHEET

Rolled sterling silver (Feb. 26) 46¾c. per Troy oz. upward according to quantity. (Duty, 65% ad valorem.)

BRASS AND BRONZE MATERIAL

	Yellow Brass	Red Brass	Comm'l. Bronze	Duty	U. S. Import Tax
Sheet	20¾c.	21¾c.	22½	4c. lb.	4c. lb. on copper content.
Wire	20¾c.	21¾c.	22¾	20%	
Rod	16½c.	21¾c.	22½	4c. lb.	
Angles, channels	28¾c.	29¾c.	31	12c. lb.	
Seamless tubing	22¾c.	23¾c.	24¾	8c. lb.	
Open seam tubing	28¾c.	29¾c.	31	20% a. v.	

TOBIN BRONZE AND MUNTZ METAL

(Duty 4c. lb.; import tax 4c. lb. on copper content.)

Tobin Bronze Rod	22 c.
Muntz or Yellow Rectangular and other sheathing	23¾c.
Muntz or Yellow Metal Rod	19½c.

ZINC AND LEAD SHEET

	Cents per lb.	Duty
Zinc sheet, carload lots, standard sizes and gauges, at mill, less 7 per cent discount	12.00	2c. lb.
Zinc sheet, 1200 lb. lots (jobbers' prices)	12.75	2c. lb.
Zinc sheet, 100 lb. lots (jobbers' prices)	16.75	2c. lb.

Full Lead Sheet (base price)	10.25	2½c. lb.
Cut Lead Sheet (base price)	10.50	2½c. lb.

BLOCK TIN, PEWTER AND BRITANNIA SHEET

(Duty Free)

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f. o. b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply Prices on page 146.

Supply Prices, February 26, 1937

ANODES

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 500 lbs. or more, and subject to changes due to fluctuating metal markets.

Copper: Cast	24¼c. per lb.	Nickel: 90-92%	.45 per lb.
Electrolytic, full size, 19½c. cut to size	19½c. per lb.	95-97%	.46 per lb.
Rolled oval, straight, 19½c.; curved.	20½c. per lb.	99%+cast, 47c.; rolled, depolarized, 48.	
Brass: Cast	22½c. per lb.	Silver: Rolled silver anodes .999 fine were quoted Feb. 26,	
Zinc: Cast	12¼c. per lb.	from 46¾c. per Troy ounce upward, depending on quantity.	

WHITE SPANISH FELT POLISHING WHEELS

Even Diameters	Thickness	Under 50 lb.	50 to 100 lb.	Over 100 lb.
10-18	1" to 2"	\$2.45-2.95	\$2.33-2.65	\$2.21-2.45
10-18	2 to 3½	2.45-2.85	2.33-2.55	2.21-2.35
6-8 & over 18	1 to 2	2.45-3.05	2.33-2.75	2.21-2.55
6-8 & over 18	2 to 3½	2.45-3.00	2.33-2.70	2.21-2.50
6-8 & over 18	Over 3½	3.00-3.35	2.85-3.05	2.70-2.85
6-8 & over 18	Under ½	3.80-4.25	3.61-3.95	3.42-3.75

Odd Diameters

Less than 50 lbs.—add 40c. per lb. to "Even Diameters" list.
50 lbs. or over—all one size and consistency and in one shipment—same as "Even Diameters."

Extras: 25c per lb. on wheels, 1 to 6 in. diam., over 3 in. thick.
On grey Mexican wheels deduct 10c. per lb. from above prices.

COTTON BUFFS

Full disc open buffs, per 100 sections when purchased in lots of 100 or less are quoted:

16" 20 ply 84/92 Unbleached	\$78.28
14" 20 ply 84/92 Unbleached	59.99
12" 20 ply 84/92 Unbleached	45.08
16" 20 ply 80/92 Unbleached	69.99
14" 20 ply 80/92 Unbleached	53.69
12" 20 ply 80/92 Unbleached	40.40
16" 20 ply 64/68 Unbleached	60.51
14" 20 ply 64/68 Unbleached	46.48
12" 20 ply 64/68 Unbleached	35.04
¾" Sewed Buffs, per lb., bleached or unbleached	53c to \$1.40

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone C. P.	lb.	.07½	Lead—Acetate (Sugar of Lead), bbls.	lb.	.11½-14¼
Acid—Boric (Boracic) granular, 99½% + % ton lots.	lb.	.05¼-.05¾	Oxide (Litharge), bbls.	lb.	.12½
Chromic, 400 or 100 lb. drums	lb.	.16¼-.16¾	Lime Compositions for Nickel	lb.	.09½-.11
Hydrochloric (Muriatic) Tech., 20 deg., carboys.	lb.	.03	Lime Compositions for Brass	lb.	.09½-.11
Hydrochloric, C. P., 20 deg., carboys	lb.	.06½	Mercury Bichloride (Corrosive Sublimate)	lb.	\$1.58
Hydrofluoric, 30%, bbls.	lb.	.07-.08	Methanol, (Wood Alcohol) Pure, drums	gal.	.40½
Nitric, 36 deg., carboys	lb.	.05-.06¼	Nickel—Carbonate, dry, bbls.	lb.	.36-41
Nitric, 42 deg., carboys	lb.	.07-.08	Chloride, bbls.	lb.	.18-22
Sulphuric, 66 deg., carboys	lb.	.029	Salts, single, 425 lb. bbls.	lb.	.13½-.14½
Alcohol—Butyl, drums	lb.	.09½-.10½	Salts, double, 425 lb. bbls.	lb.	.13½-.14½
Denatured, drums	gal.	.30-476	Paraffin	lb.	.05-.06
Alum—Lump, barrels	lb.	.03¼-.03½	Phosphorus—Duty free, according to quantity	lb.	.35-.40
Powdered, barrels	lb.	.0340-.0365	Potash Caustic Electrolytic 88-92% broken, drums.	lb.	.07¼-.08¼
Ammonia, aqua, com'l., 26 deg., drums, carboys.	lb.	.02½-.05	Potassium—Bichromate, casks (crystals)	lb.	.09
Ammonium—Sulphate, tech., bbls.	lb.	.03½-.05	Carbonate, 98-100%	lb.	.06¼
Sulphocyanide, technical crystals, kegs	lb.	.55-.58	Cyanide, 165 lbs. cases, 94-96%	lb.	.57½
Arsenic, white kegs	lb.	.04½-.05	Pumice, ground, bbls.	lb.	.02½
Asphaltum, powder, kegs	lb.	.23-41	Quartz, powdered	ton	\$30.00
Benzol, pure, drums	gal.	.41	Rosin, bbls.	lb.	.04½
Borax, granular, 99½% + %, ton lots	lb.	.0245-.0295	Sal Ammoniac (Ammonium Chloride) in bbls.	lb.	.05-.07½
Cadmium oxide, 50 to 1,000 lbs.	lb.	1.05	*Silver—Chloride, dry, 100 oz. lots	oz.	.38
Calcium Carbonate (Precipitated Chalk), U. S. P.	lb.	.05¼-.07½	Cyanide, 100 oz. lots	oz.	.44
Carbon Bisulphide, drums	lb.	.05½-.06	Nitrate, 100 ounce lots	oz.	.32¼
Chrome, Green, commercial, bbls.	lb.	.20-.23	Soda Ash, 58%, bbls.	lb.	.0225
Chromic Sulphate, drums	lb.	.33-.55	Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.17½-.22
*Copper—Acetate (Verdigris)	lb.	.28	Hyposulphite, kegs, bbls.	lb.	.03½-.06½
Carbonate, 53/55% cu., bbls.	lb.	.17¼-.18¼	Metasilicate, granular, bbls.	lb.	2.75-3.15
Cyanide (100 lb. kgs.)	lb.	.37-.38	Nitrate, tech., bbls.	lb.	.0240
Sulphate, tech., crystals, bbls.	lb.	.051-.058	Phosphate, tribasic, tech., bbls.	lb.	.03
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.20¼-.20½	Silicate (Water Glass), bbls.	lb.	.01½
Crocus Martis (Iron Oxide) red, tech., kegs	lb.	.07	*Stannate, drums	lb.	.35-.38
Dextrin, yellow, kegs	lb.	.05-.08	Sulphocyanide, drums	lb.	.30-.45
Emery Flour (Turkish)	lb.	.07	Sulphur (Brimstone), bbls.	lb.	.02¼
Flint, powdered	ton	30.00	*Tin Chloride, 100 lb. kegs	lb.	.41
Fluorspar, bags	lb.	.03½	Tripoli, powdered	lb.	.03
*Gold Chloride	oz.	\$18¼-.23	Trisodium Phosphate—see Sodium Phosphate.		
*Gold Cyanide, Potassium	lb.	\$15.45	Wax—Bees, white, ref. bleached	lb.	.60
*Gold Cyanide, Sodium	lb.	\$17.10	Yellow, No. 1	lb.	.45
Gum—Sandarac, prime, bags	lb.	.50	White Silica Compositions for Brass	lb.	.07½-.10
Shellac, various grades and quantities	lb.	.21-.31	Whiting, Bolted	lb.	.02¼-.06
Iron Sulphate (Copperas), bbls.	lb.	.016	Zinc—Carbonate, bbls.	lb.	.12-.13
			Cyanide (100 lb. kegs)	lb.	.36-.38
			Chloride, drums, bbls.	lb.	.06
			Sulphate, bbls.	lb.	.0355

*Subject to fluctuations in metal prices.

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METAL INDUSTRY, April, 1937

METAL INDUSTRY

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ELECTRO-PLATERS REVIEW

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• CONTENTS •

VOLUME 35

APRIL, 1937

NUMBER 4

Editorial Comment	147
Brocading, Engine Turning and Chasing Metal Articles—By Charles W. Hardy	148
Aluminum Foil by the Hazelett Process	150
Die Castings in Automotive Applications—By C. R. Maxon	151
Commercial Standards for Mirrors	159
Foundrymen's Convention	160
Testing of Metals and Plating	161
British Metallurgists Discuss Alloying, Rolling and Testing	162
Steel Bluing—By G. B. H.	163
Some Rolling, Polishing—and Buffing Methods—By Joseph P. Sexton	164
Moisture Permeability of Aircraft Finishes	165
Anodizing Aluminum Alloys in Chromic Acid Solutions	165
Brightness of Electrodeposits and Its Measurement—By Dr. B. Egeberg and N. E. Promisel	166
Oil Quench for Tinning—By Wallace G. Imhoff	169
Anodic Coating of Magnesium	169
The Uses of Lacquer in the Metal Industries—By Gustav Klinkenstein	170
Oxidizing to Prevent Spotting Out—By G. B. H.	173
The pH of Alkaline Electroplating Solutions—By Dr. Richard Springer	174
Reclaiming Gold from Gold Filled Articles—By Jewelry Metallurgist	175
Shop Problems	176
Metal Casting Digest—By H. M. St. John	178
Modern Production Equipment	179
New Books	189
Associations and Societies	190
Personals	192
Obituaries	193
Industrial and Financial News	194
News from Field Correspondents	196
Metal Market Review	199
Metal Prices	202
Supply Prices	204

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